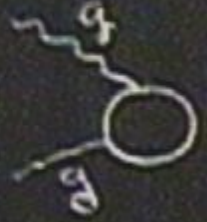
Title: Modifications to the Properties of the Higgs Boson

Date: Mar 23, 2006 10:49 AM

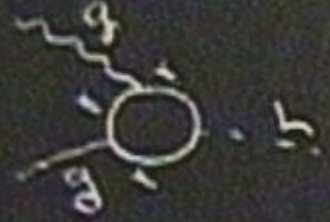
URL: http://pirsa.org/06030022

Abstract:

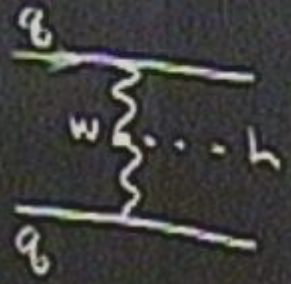
hep-th/0606212



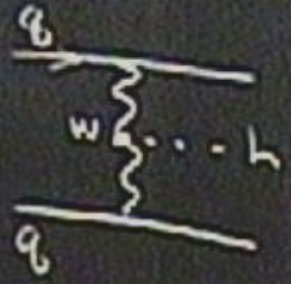
hep-th/0606212



hep-th/0601212



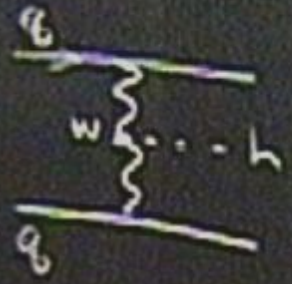
hep-ph/0601212



$\sim 10^6$ higgs

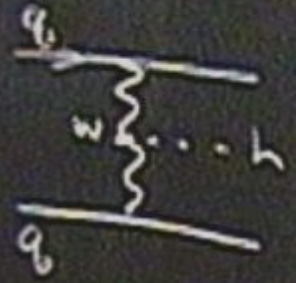
$30\,fb^{-1}$ ~ 3 years

hep-ph/0604212

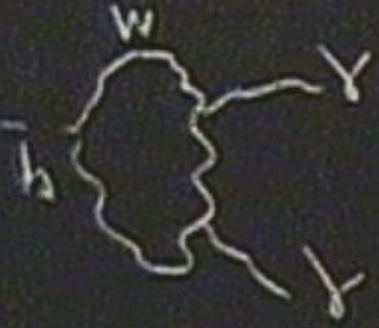


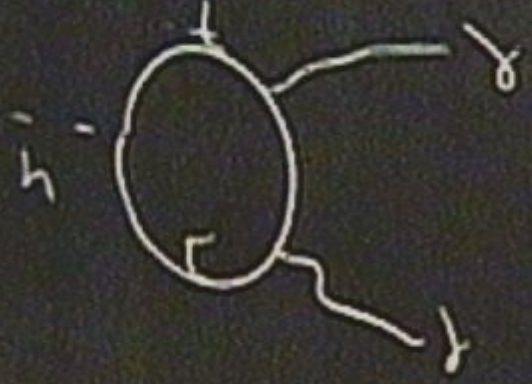
$\sim 10^4$ higgs
$30\,fb^{-1}$ ~ 3 years

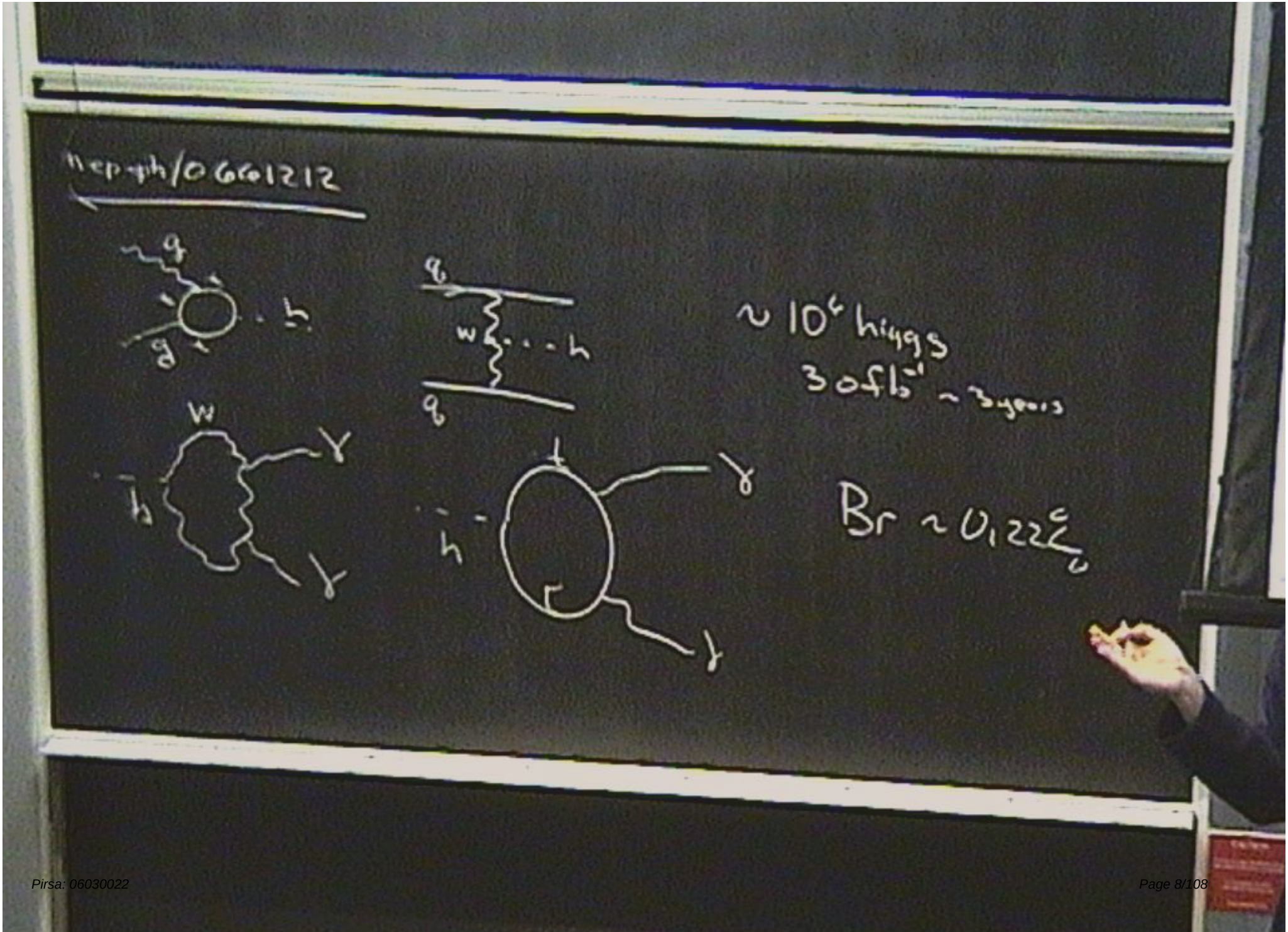
hep-ph/0606212

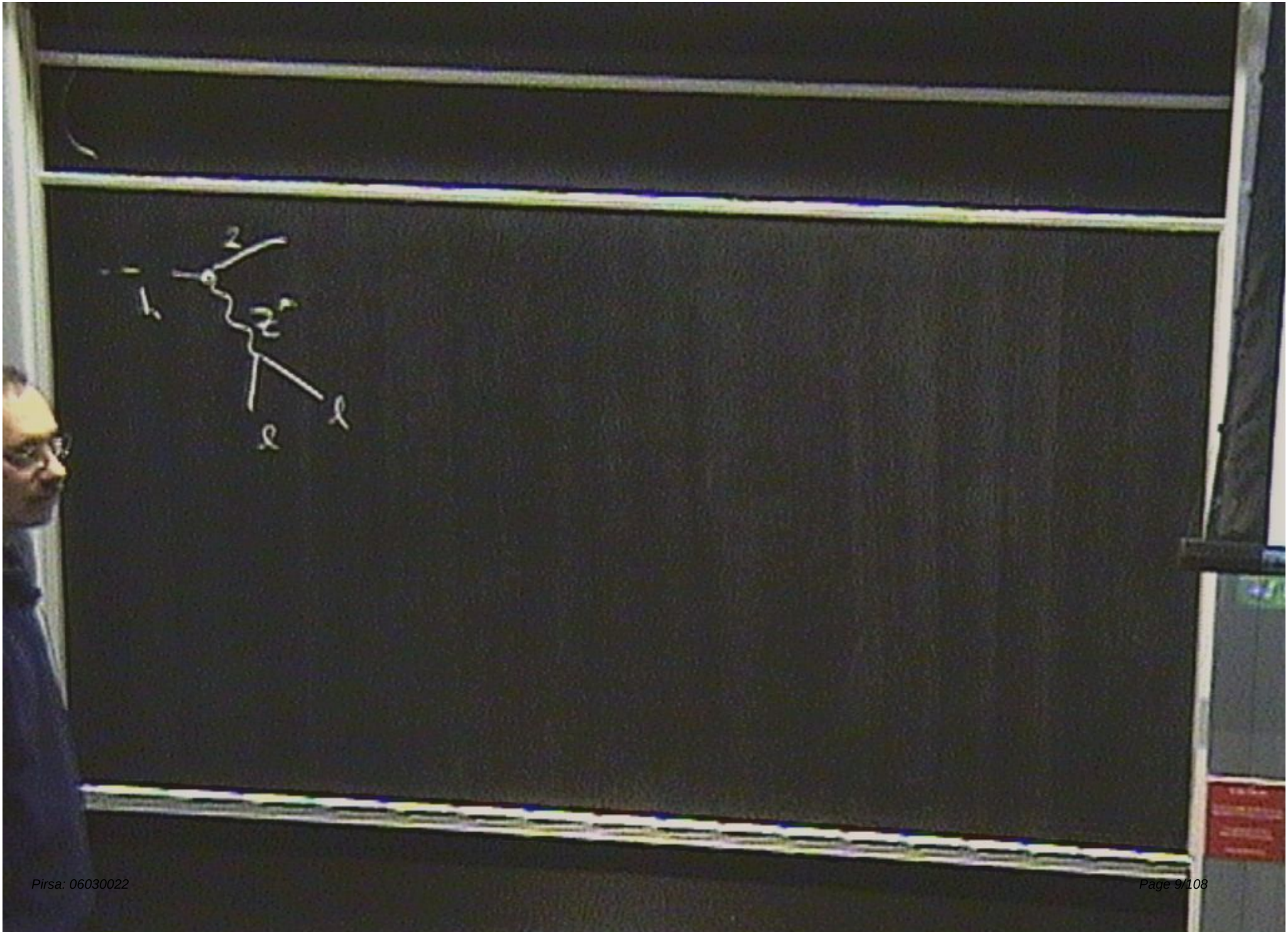


$\sim 10^6$ Higgs
$30\,fb^{-1}$ ~ 3 years

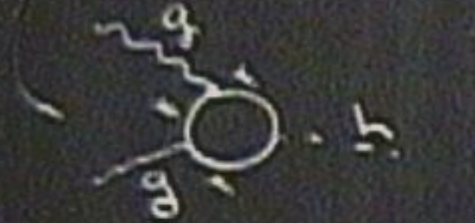


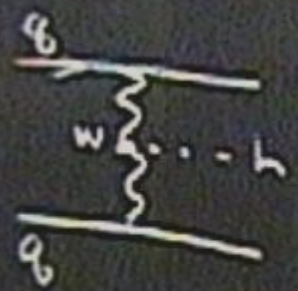



hep-ph/0601212
q
q
h
q
W
h
q
≈ 10⁶ higgs
30 fb⁻¹ ~ 3 years
W
γ
h
γ
t
γ
h
t
γ
Br ≈ 0.122 ε_b

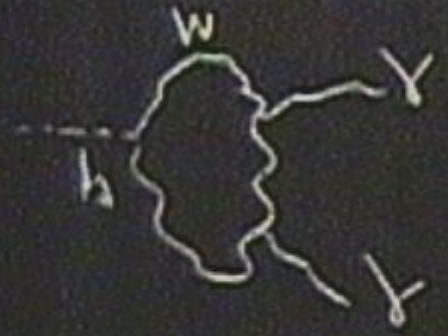

Z
l
Z*
l
l

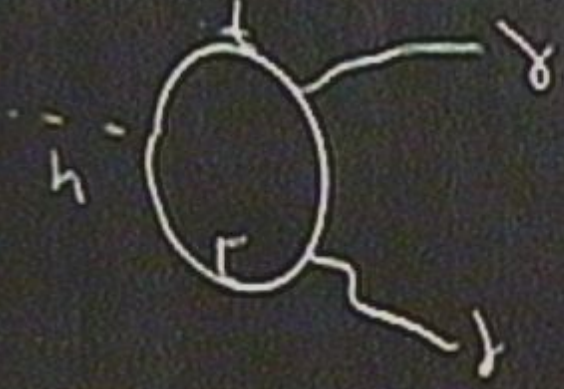
hep-ph/0606212



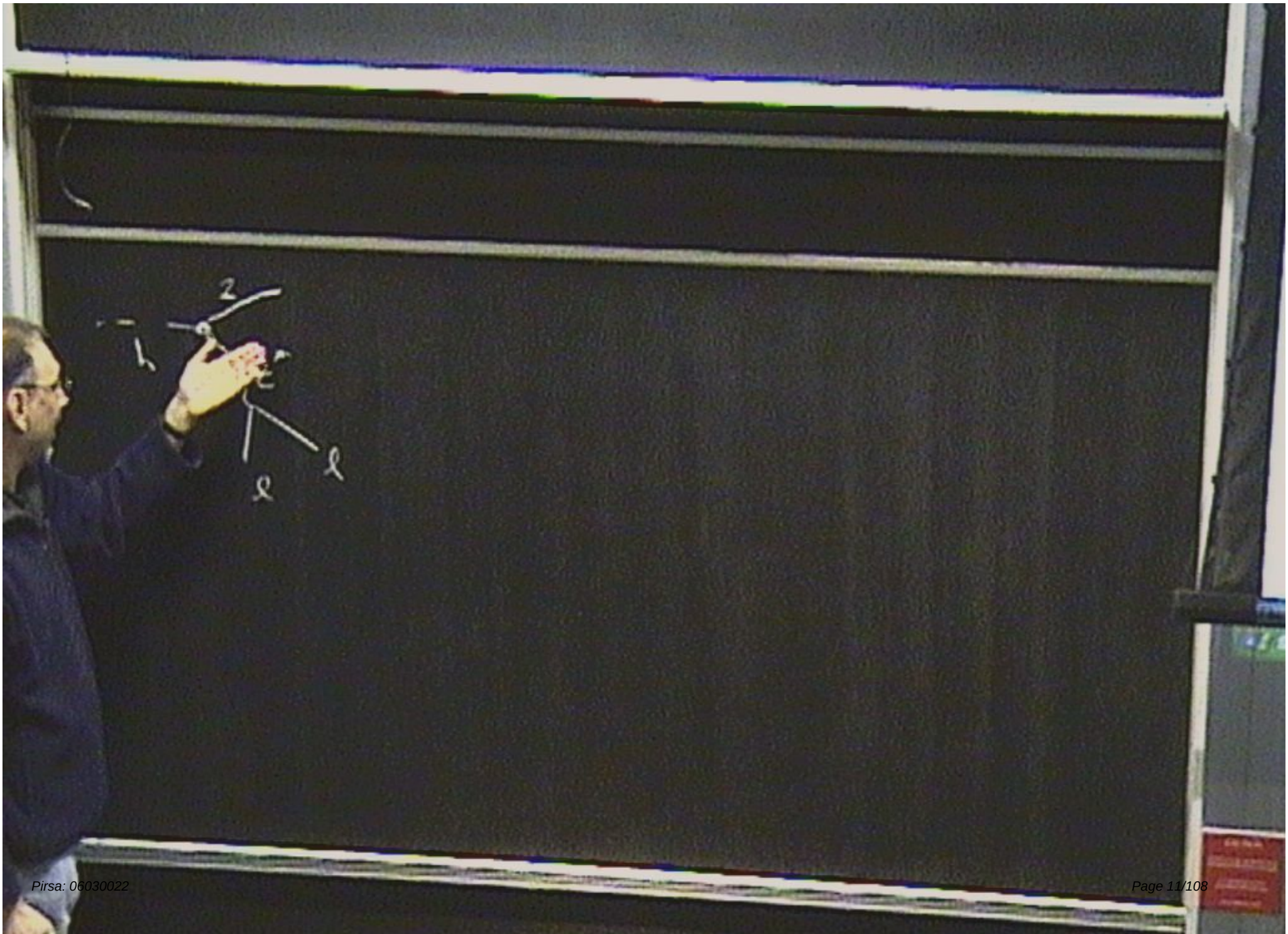


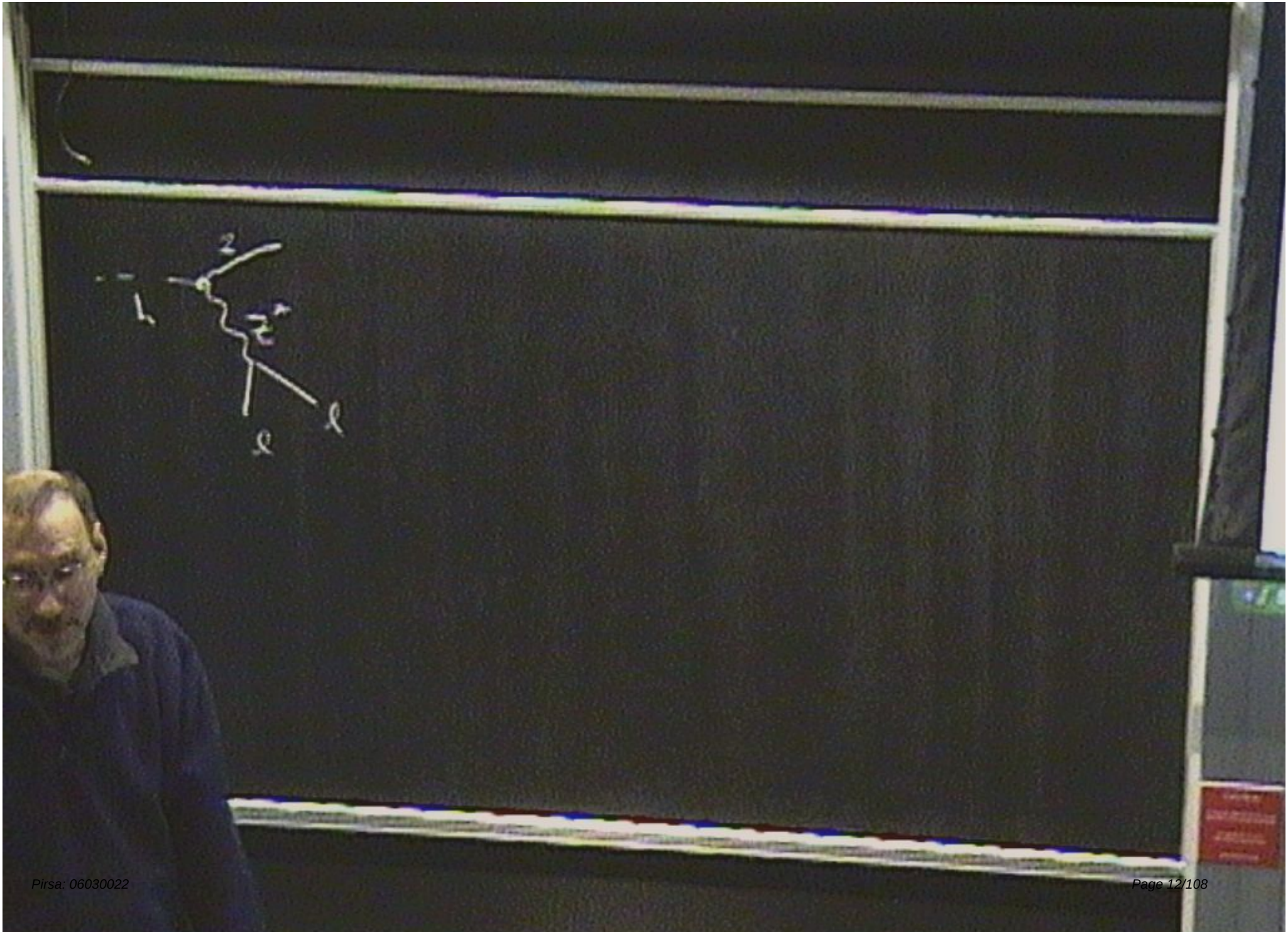
$\sim 10^6$ higgs
$30\,fb^{-1}$ ~ 3 years

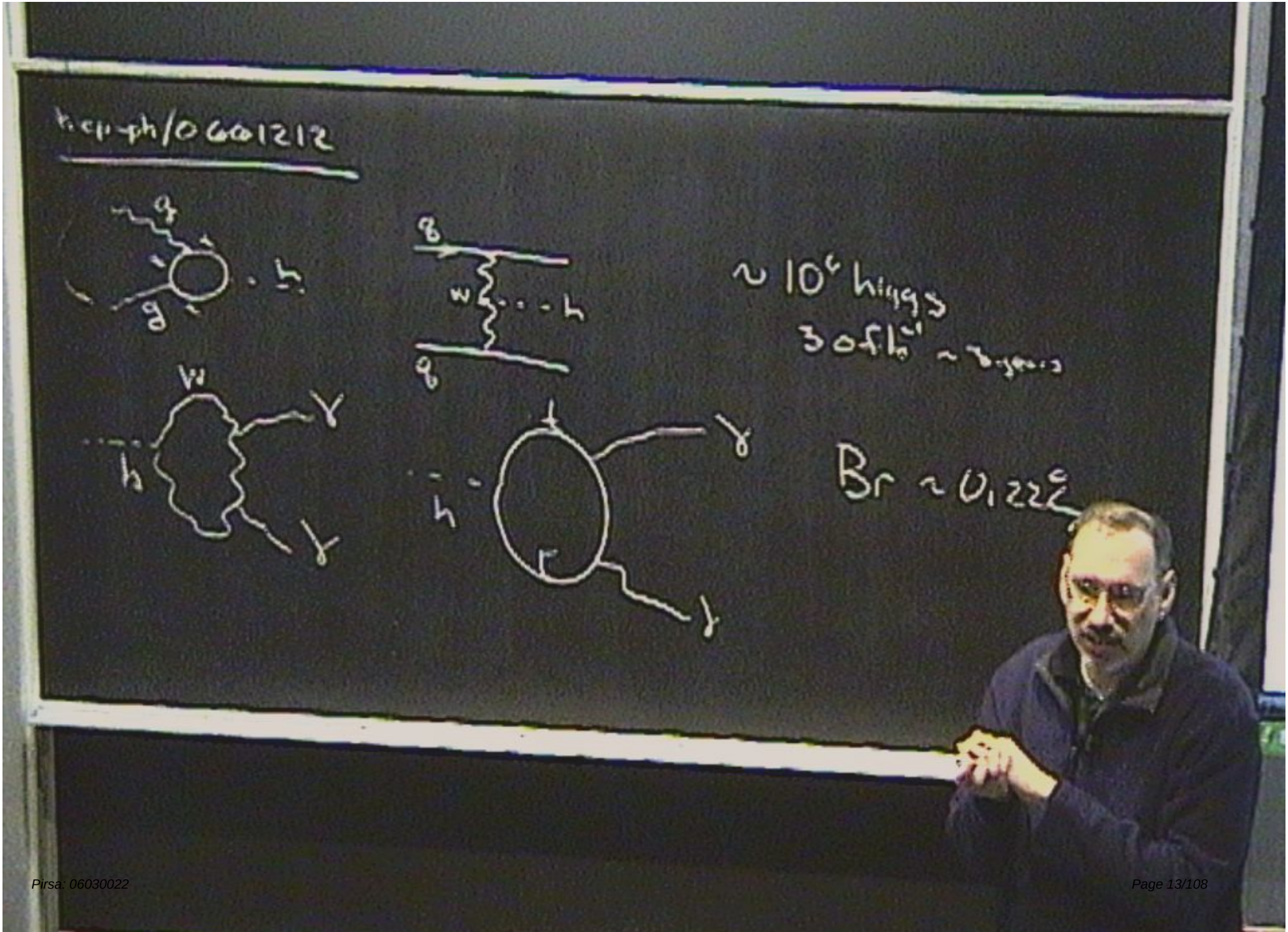


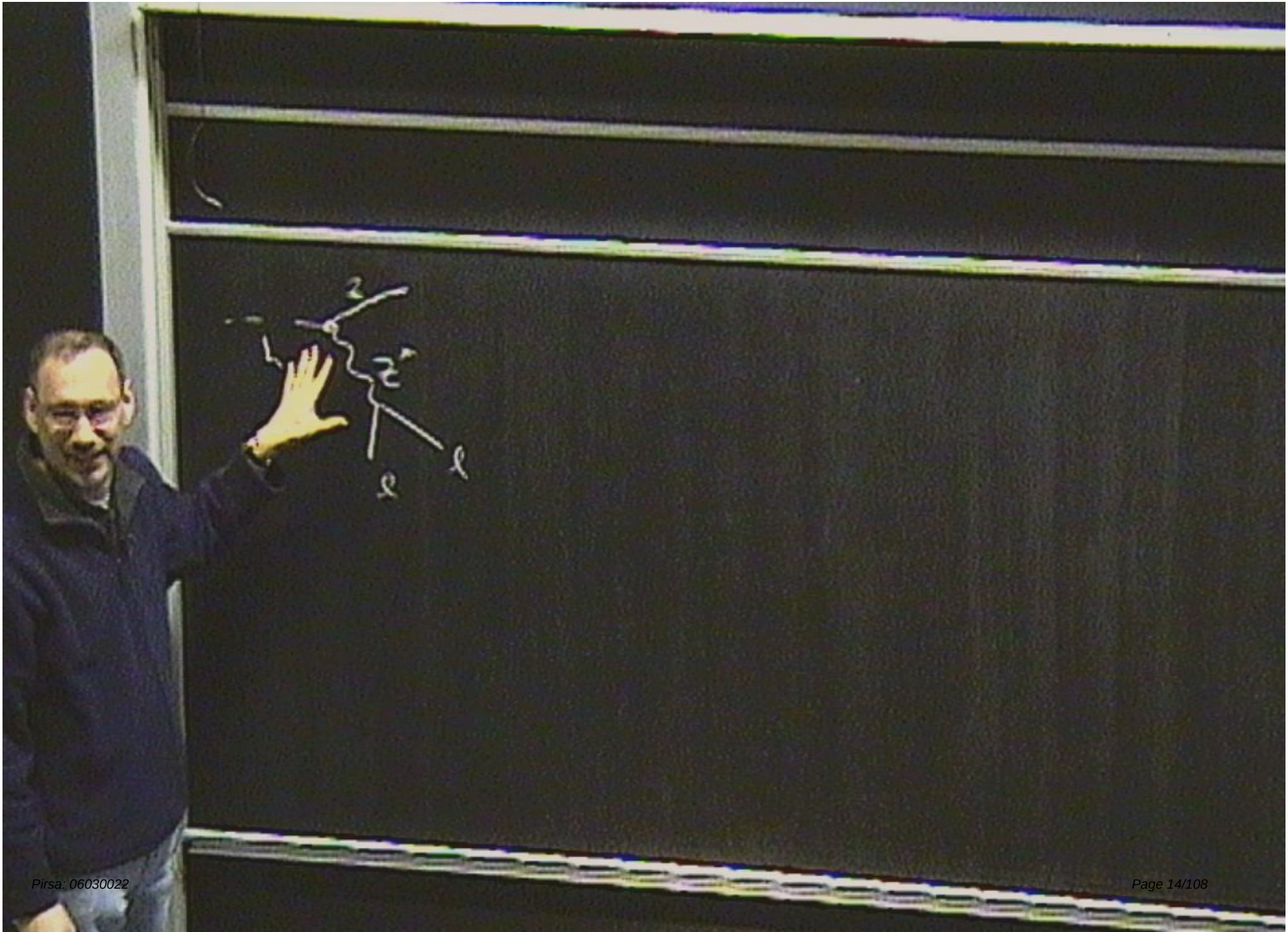


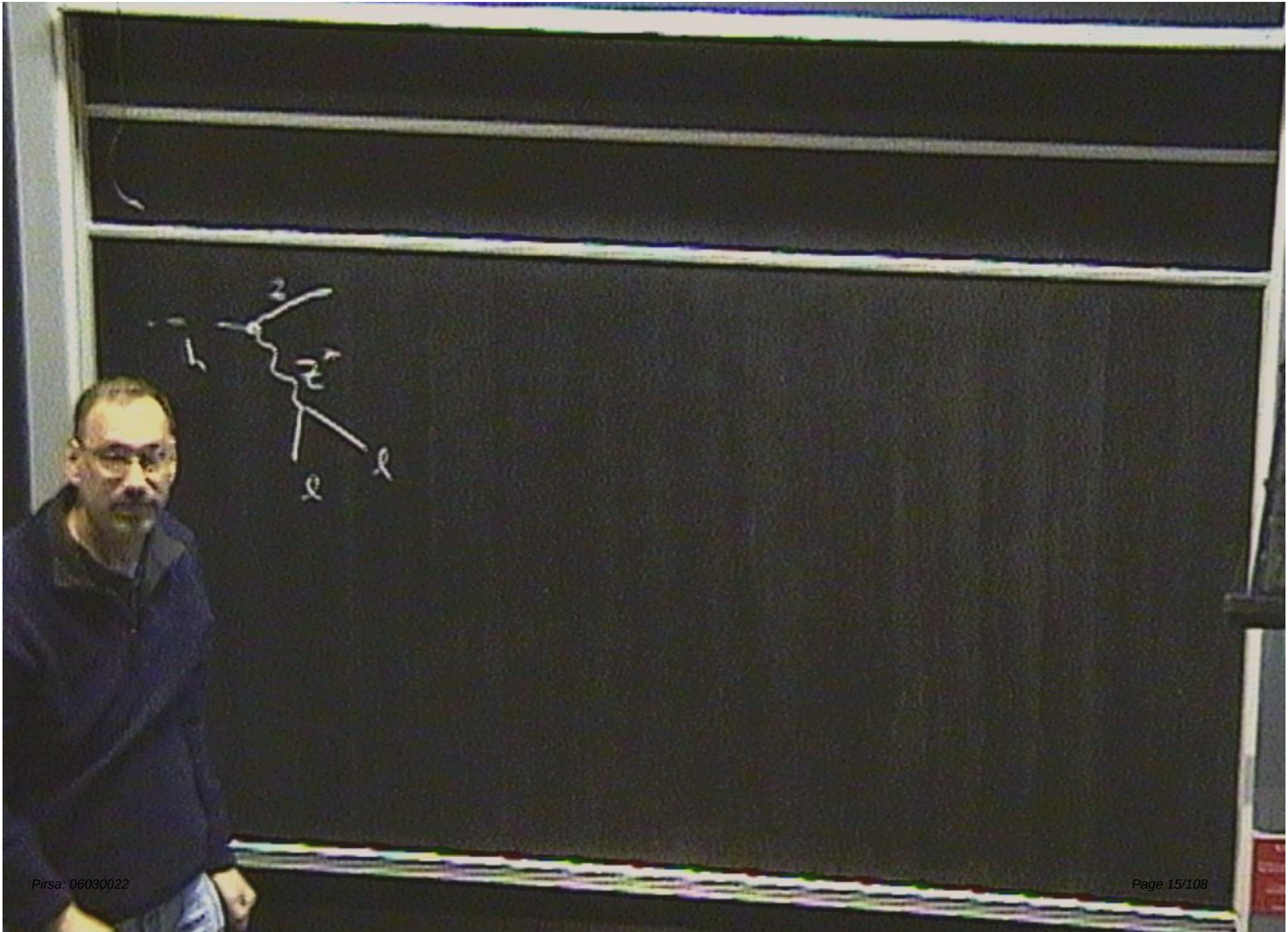
$Br \sim 0.122\,\mathcal{L}_0$

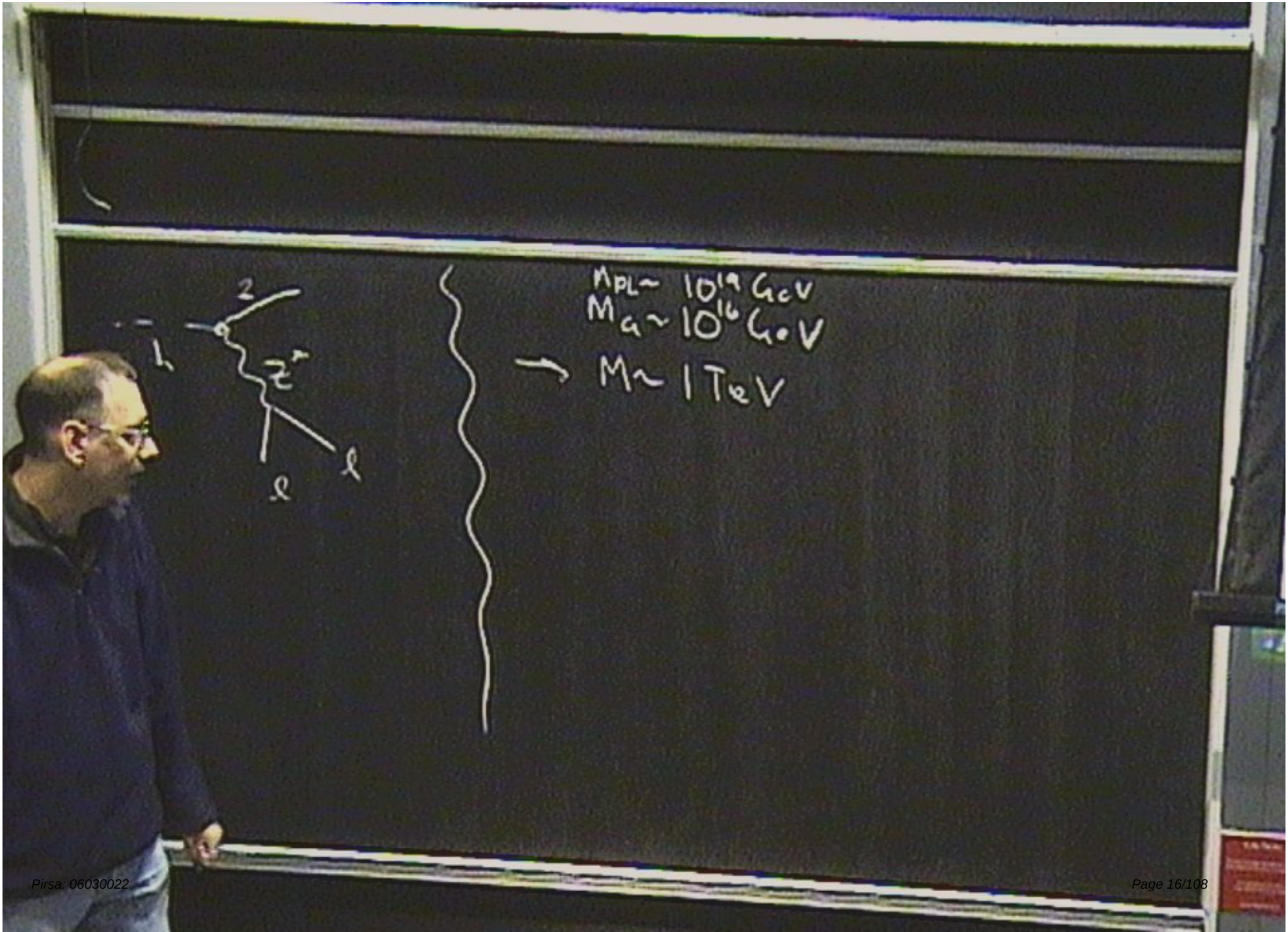

2

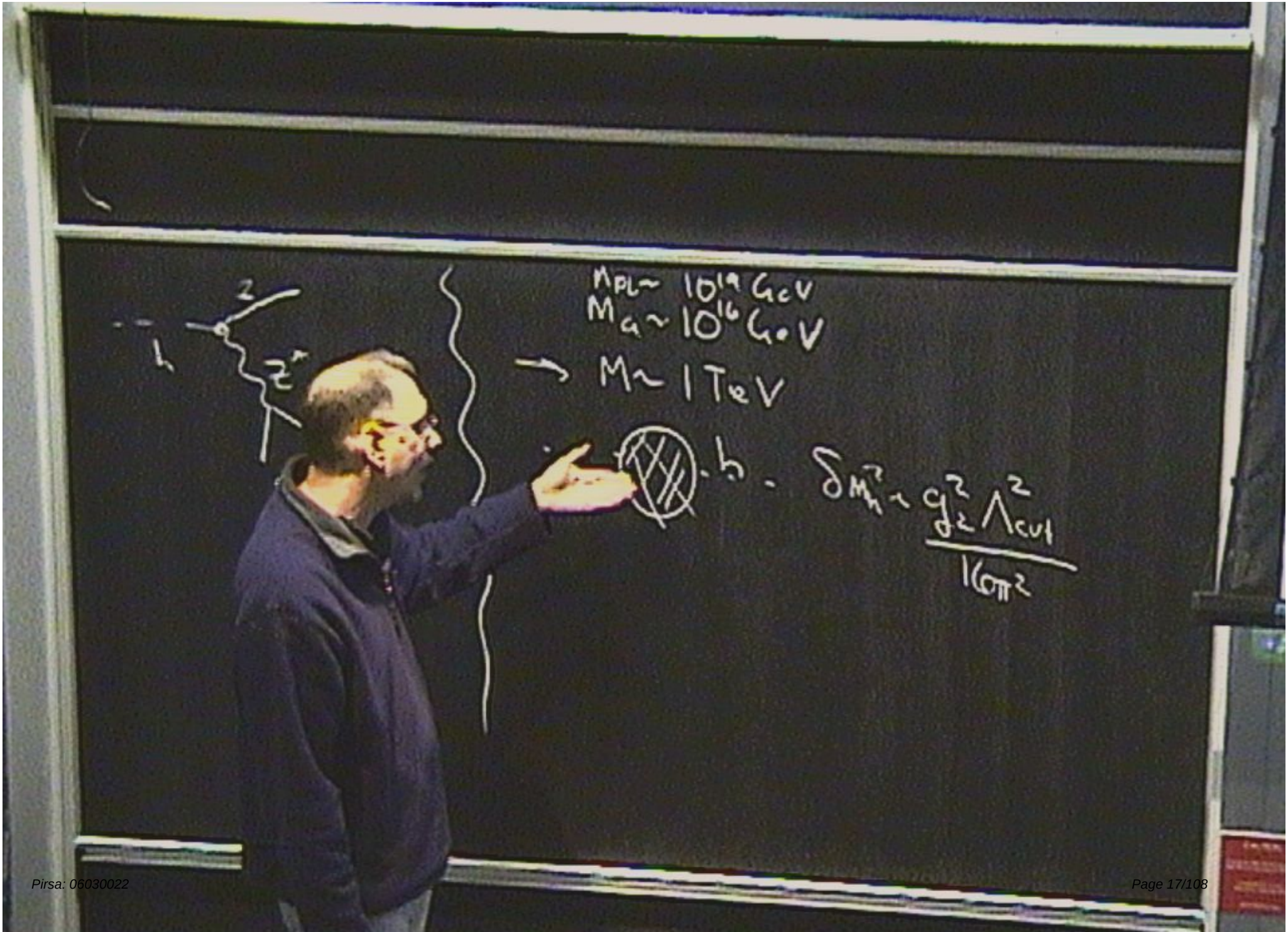

Z
h
Z*
ℓ
ℓ

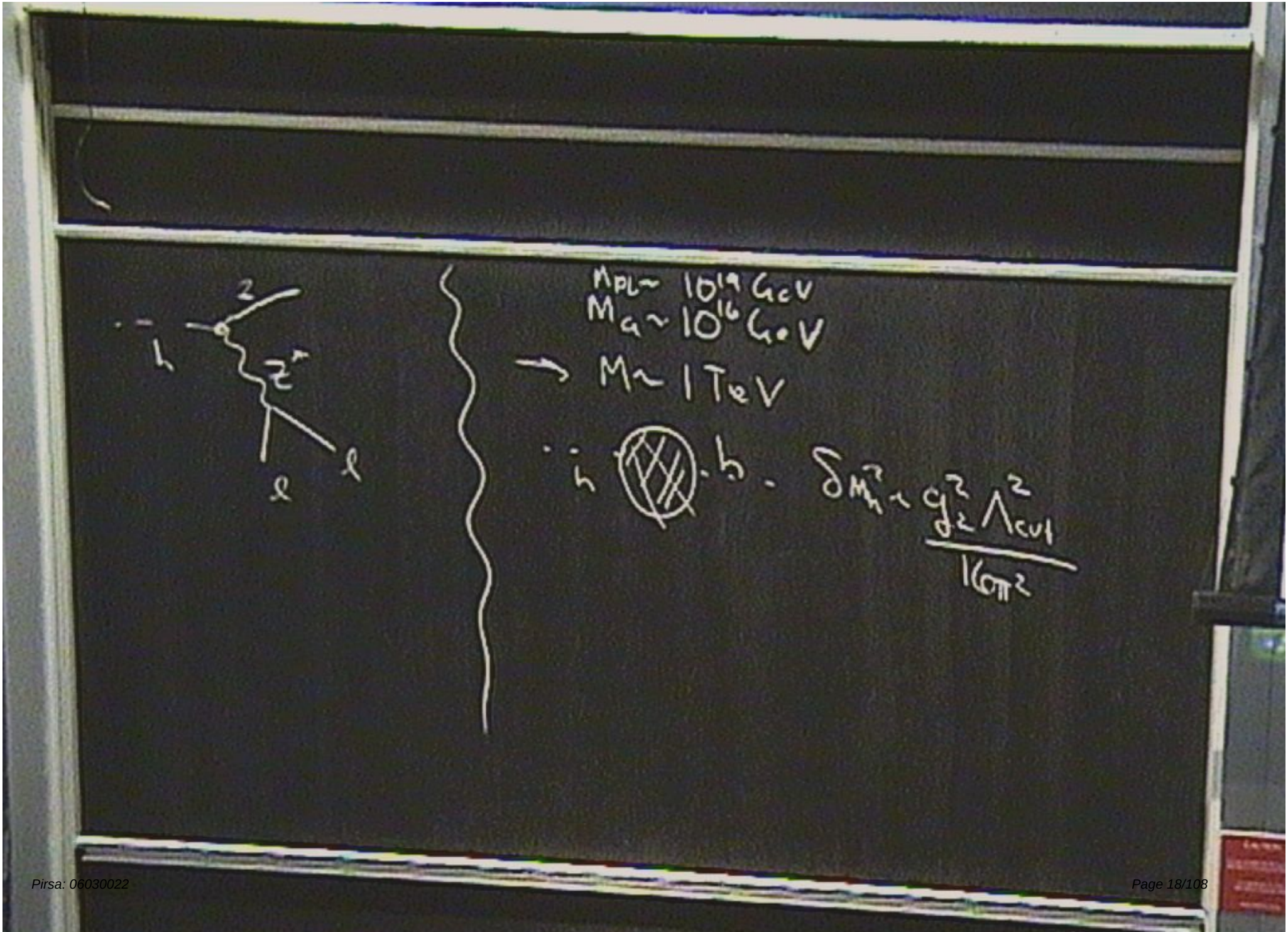

hep-ph/0601212
q
q
h
q
W
h
q
~ 10^6 higgs
W
γ
γ
h
h
Br ~ 0.122%

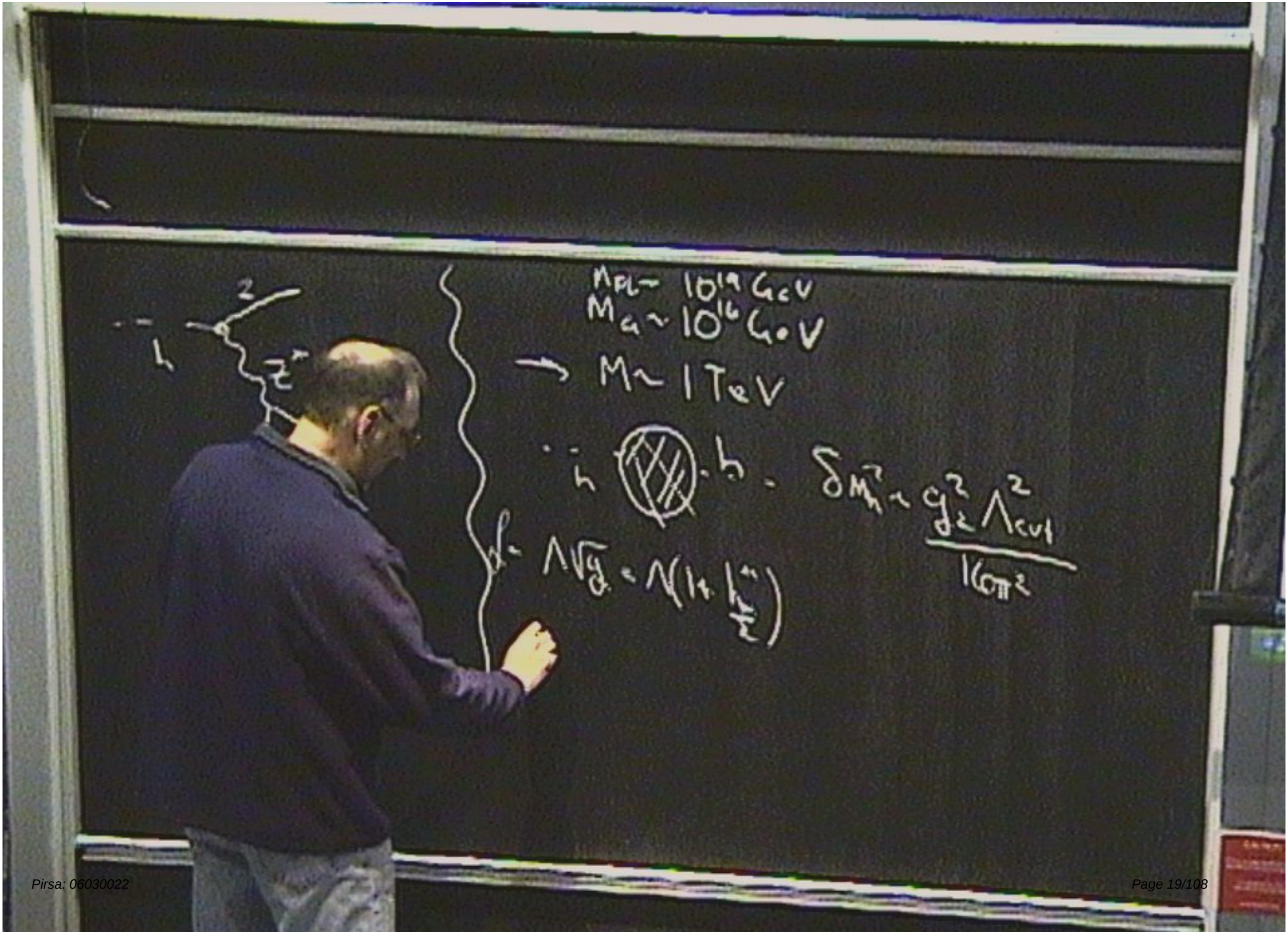

Z
Z*
ℓ
ℓ

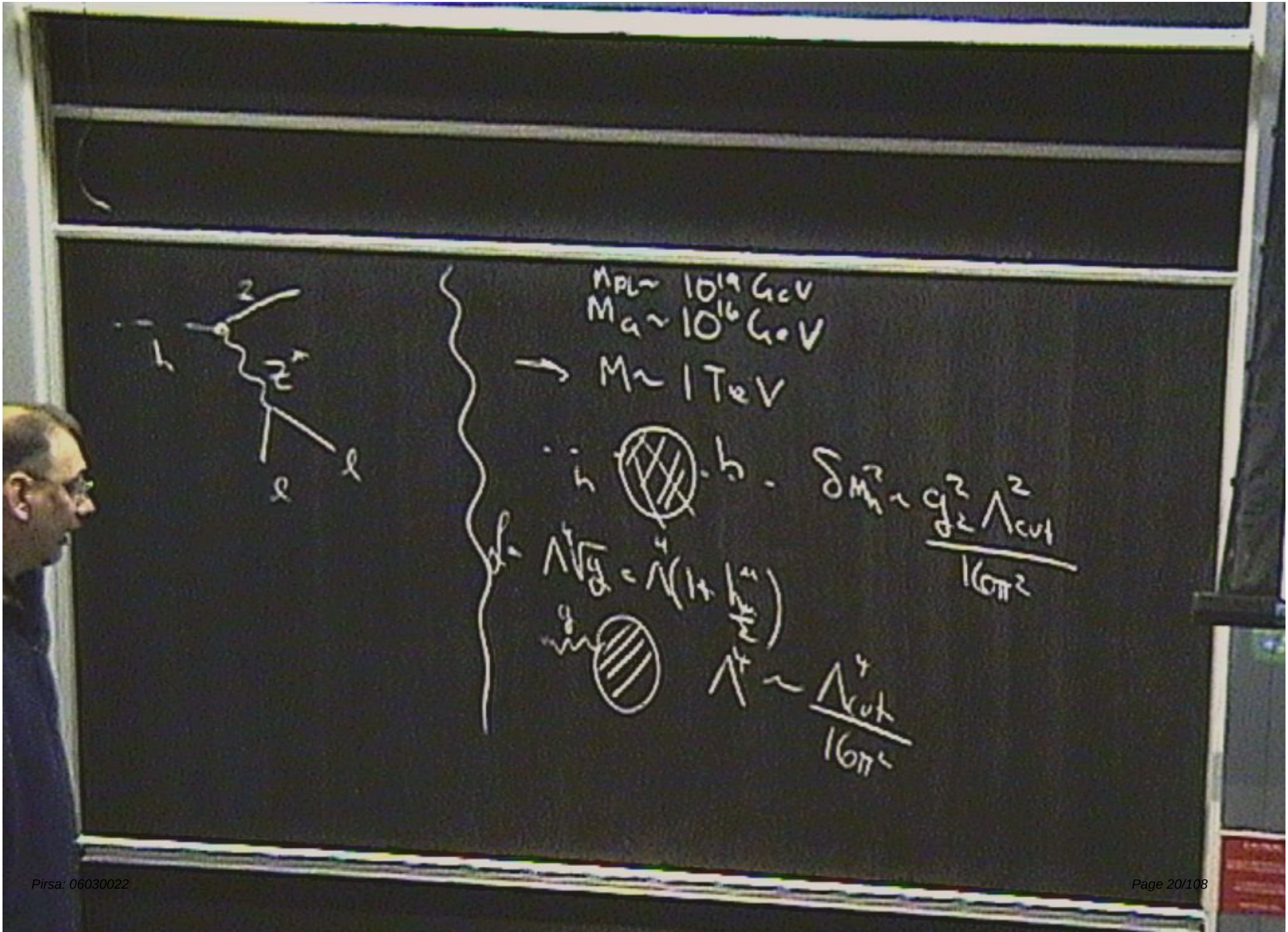

Z
h
Z*
ℓ
ℓ

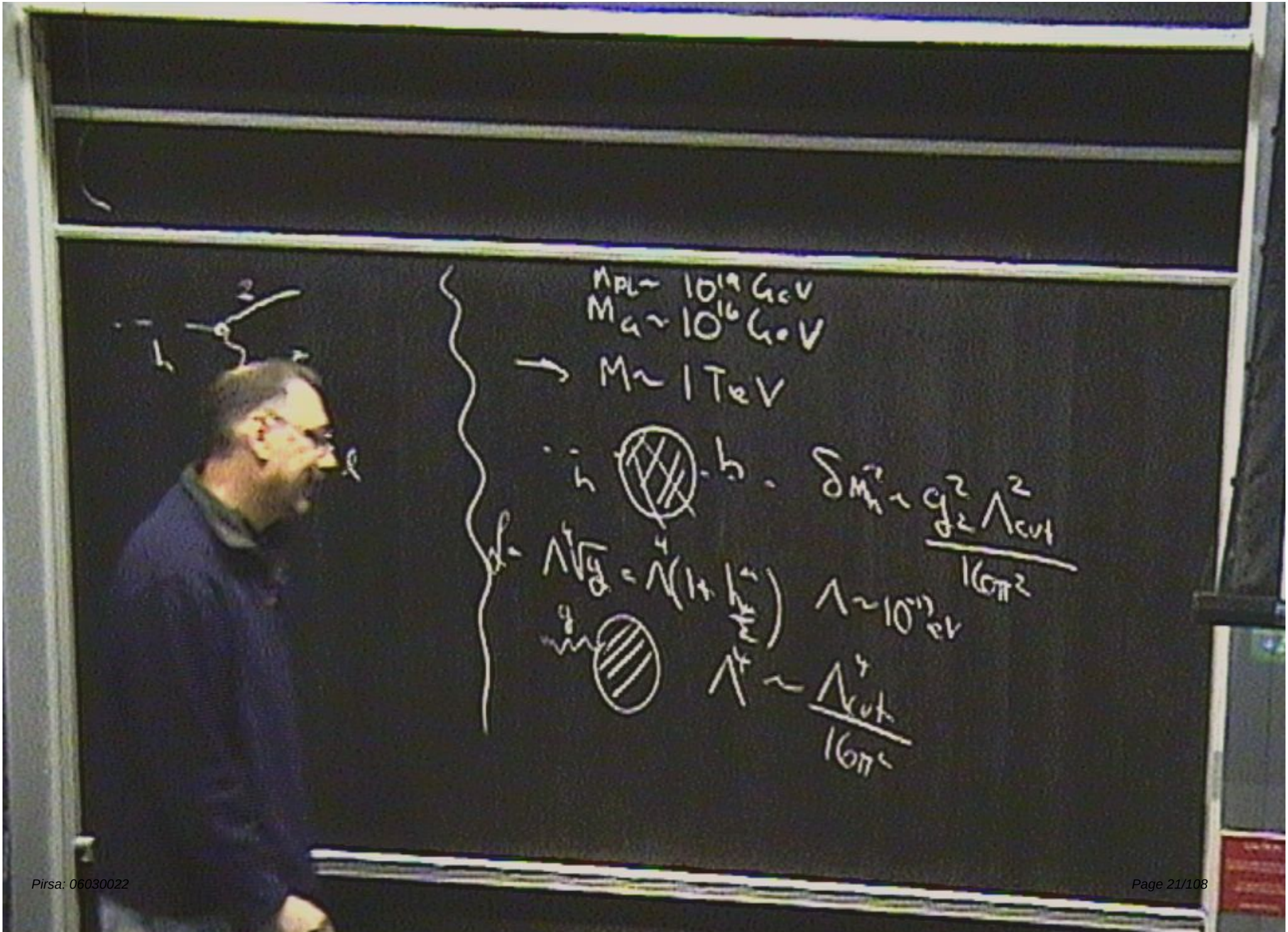

$M_{PL} \sim 10^{19}$ GeV
$M_G \sim 10^{16}$ GeV
$M \sim 1$ TeV

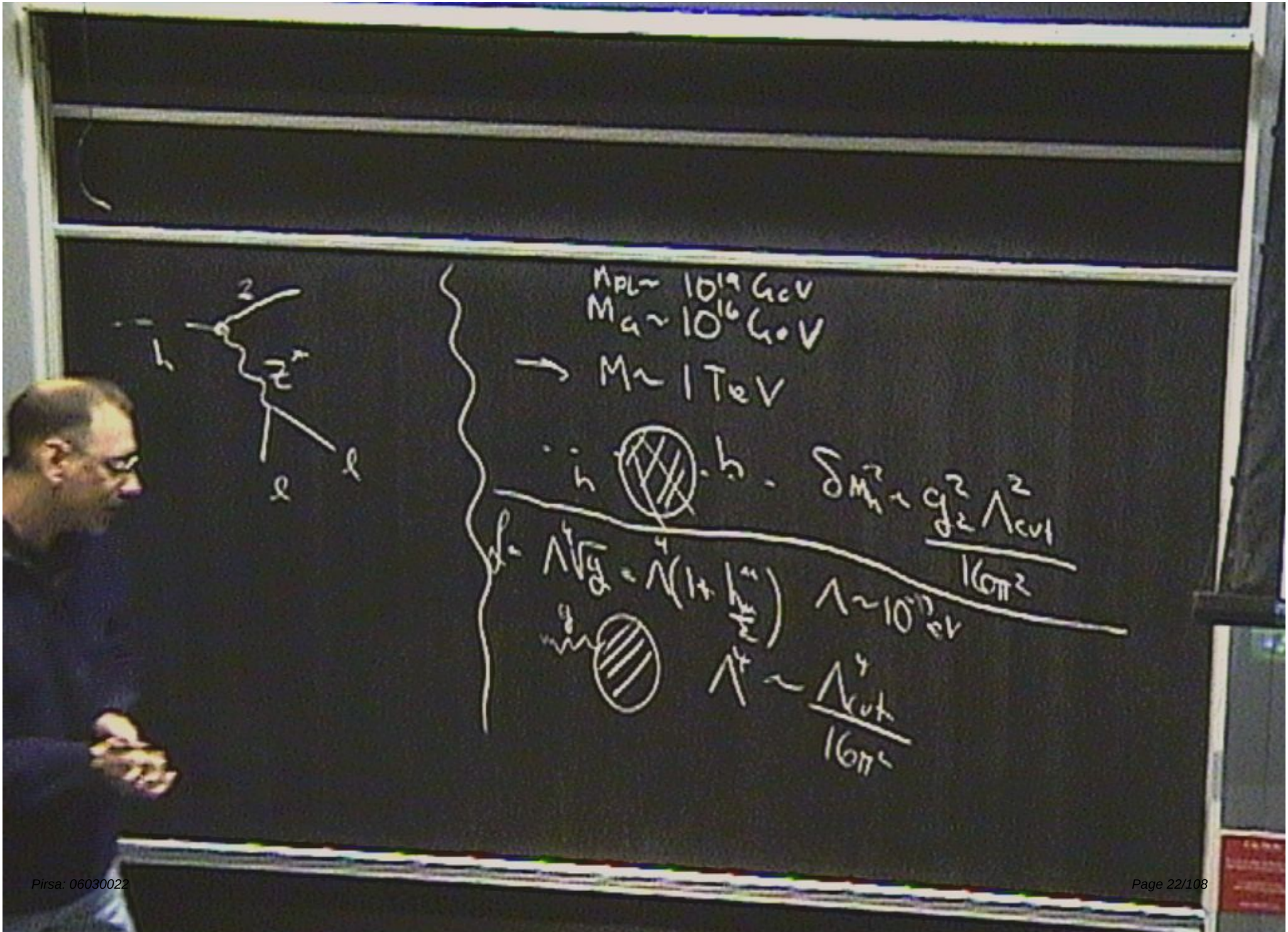

h
Z
Z
$M_{Pl} \sim 10^{19}$ GeV
$M_{GUT} \sim 10^{16}$ GeV
$M \sim 1$ TeV
h
$\delta M_h^2 \sim \frac{g_Z^2 \Lambda_{cut}^2}{16\pi^2}$

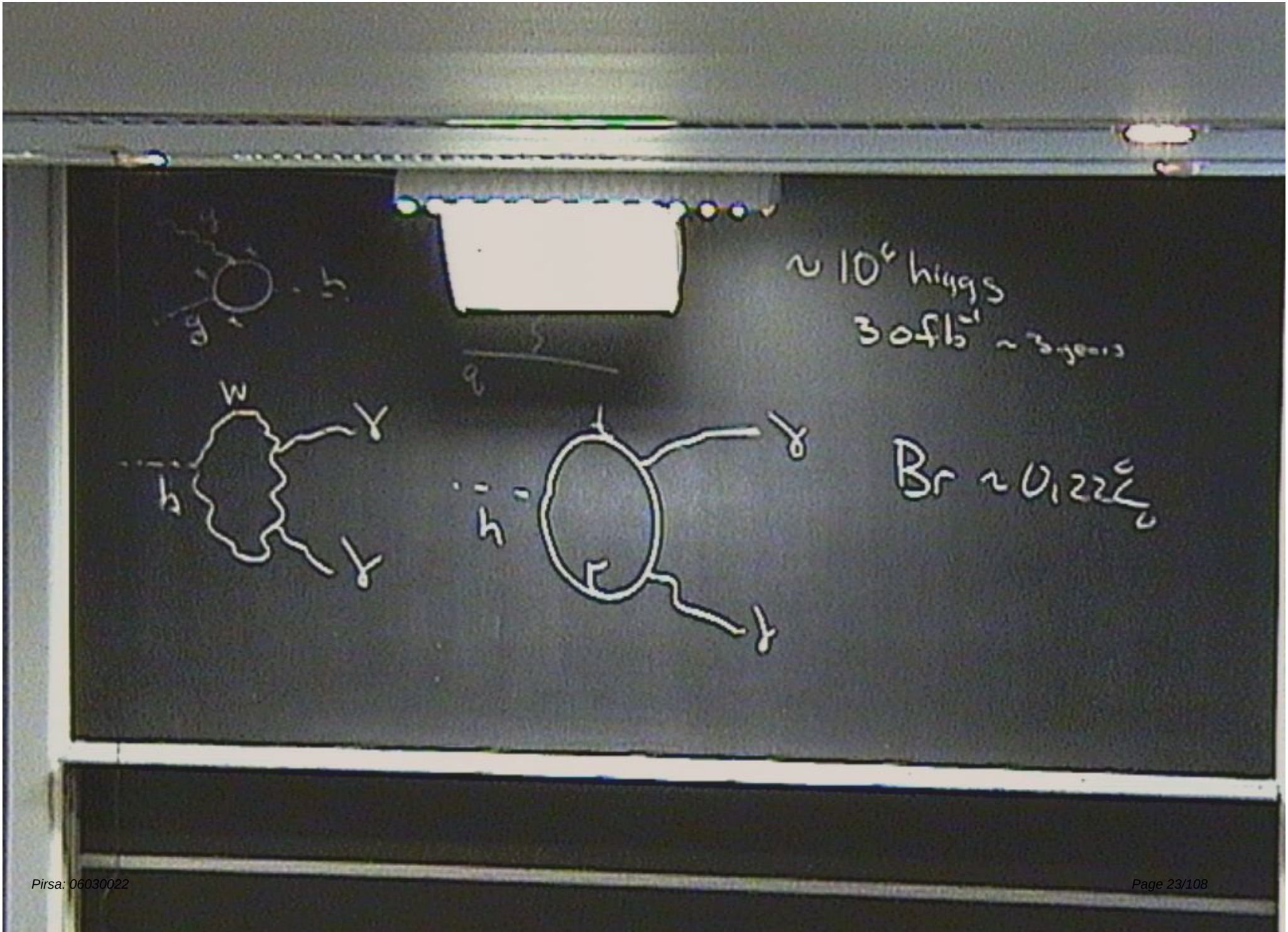

h
Z
Z*
l
l
$M_{PL} \sim 10^{19}$ GeV
$M_G \sim 10^{16}$ GeV
$\rightarrow M \sim 1$ TeV
h
h
$\delta M_h^2 \sim \frac{g_Z^2 \Lambda_{cut}^2}{16\pi^2}$

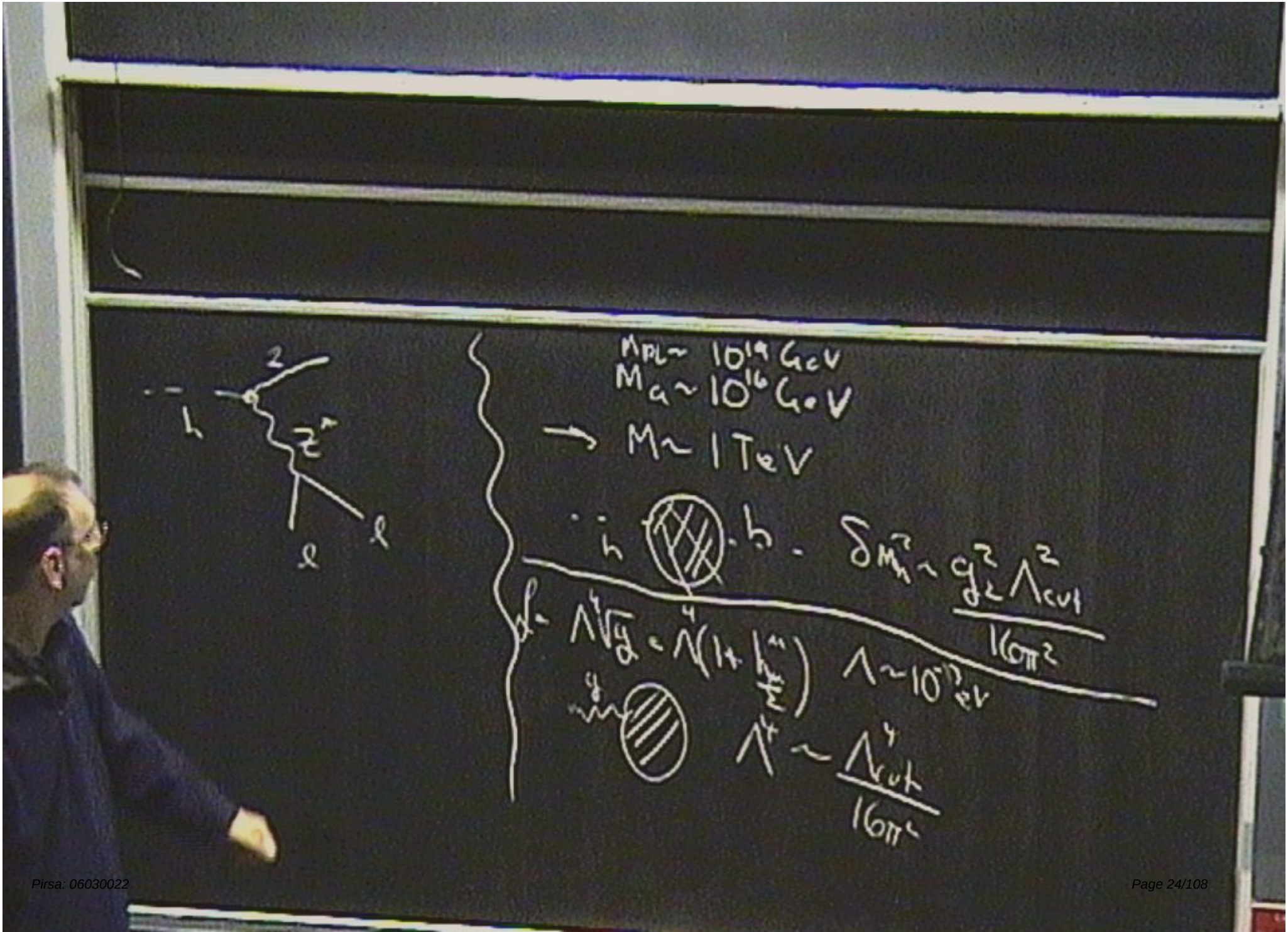

$M_{Pl} \sim 10^{19}$ GeV
$M_{GUT} \sim 10^{16}$ GeV
$\rightarrow M \sim 1$ TeV
$\delta M_h^2 \sim \frac{g_2^2 \Lambda_{cut}^2}{16\pi^2}$
$\Lambda \sqrt{g} \sim \Lambda(1 + \frac{h}{\Lambda})$

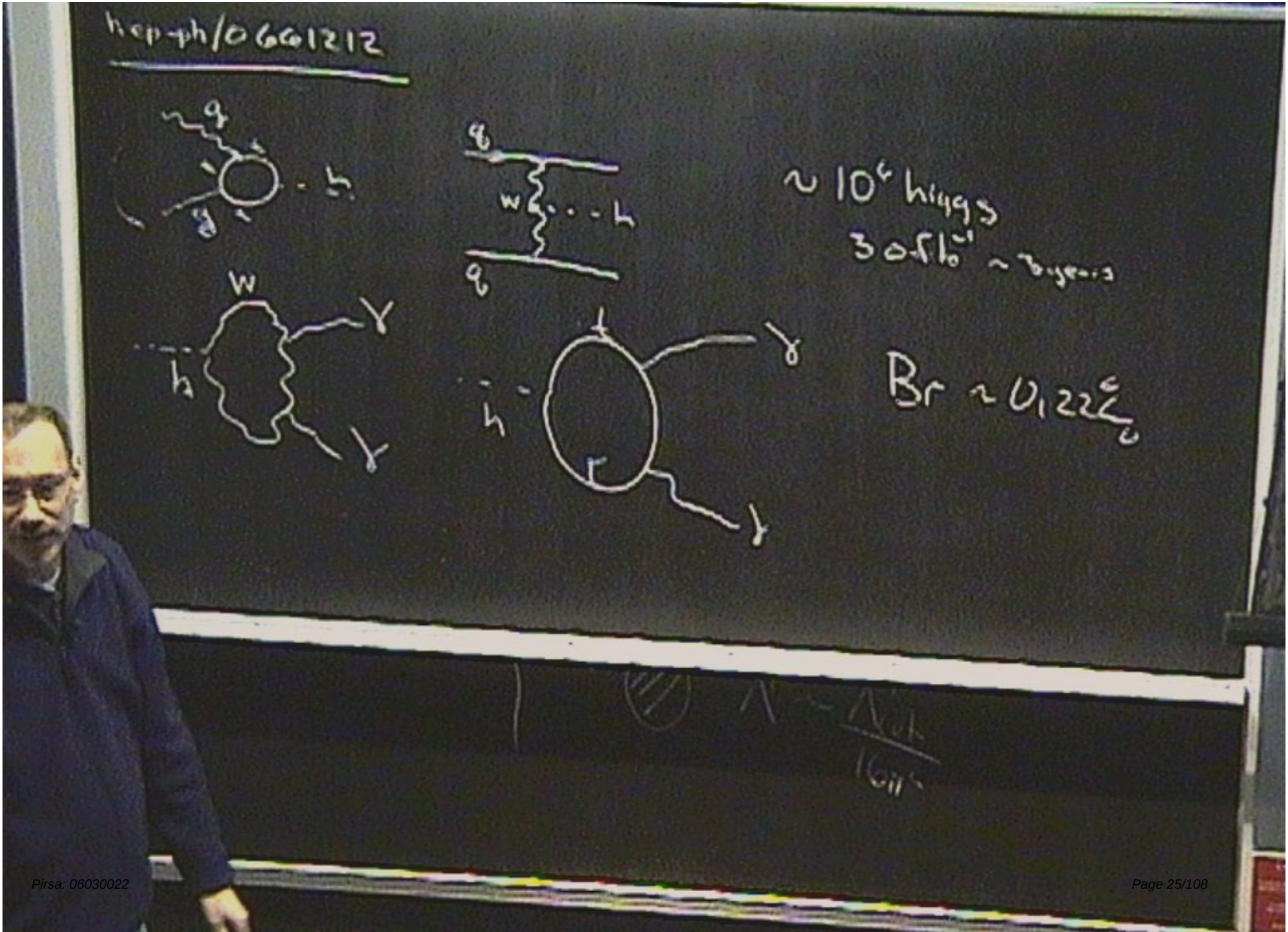

h
Z
Z*
l
l
$M_{PL} \sim 10^{19}$ GeV
$M_G \sim 10^{16}$ GeV
$M \sim 1$ TeV
h
h
$\delta m_h^2 \sim g_Z^2 \Lambda_{cut}^2 / 16\pi^2$
$\Lambda \sqrt{g} = \Lambda(1 + h/M)$
$\Lambda^4 \sim \Lambda_{cut}^4 / 16\pi^2$

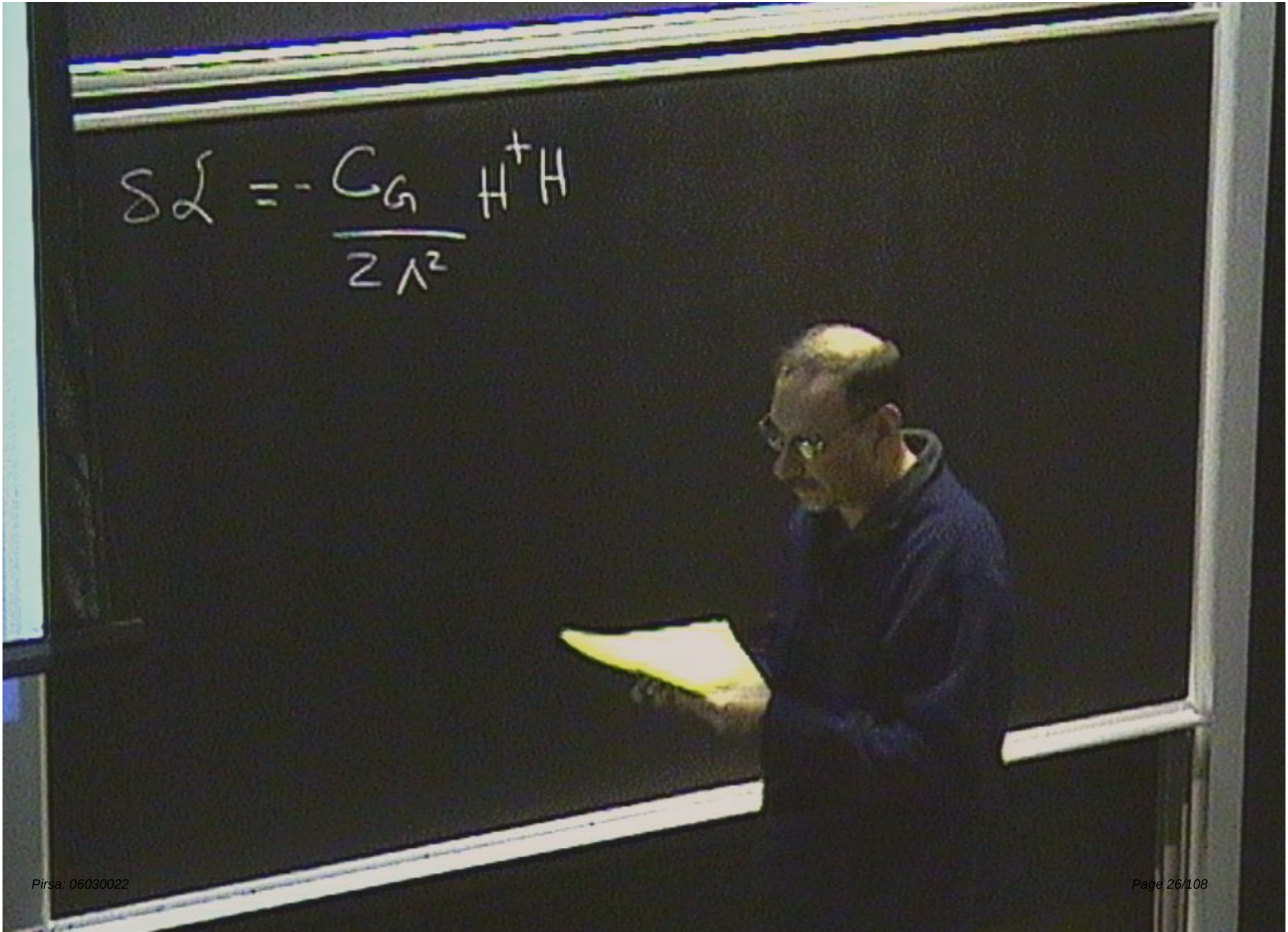

$M_{PL} \sim 10^{19}$ GeV
$M_G \sim 10^{16}$ GeV
$\rightarrow M \sim 1$ TeV
$\delta M_h^2 \sim \frac{g^2 \Lambda_{cut}^2}{16\pi^2}$
$\Lambda^4 \sqrt{g} \sim \Lambda^4 (1 + \frac{1}{M^4})$
$\Lambda \sim 10^{-3}$ eV
$\Lambda^4 \sim \frac{\Lambda_{cut}^4}{16\pi^2}$

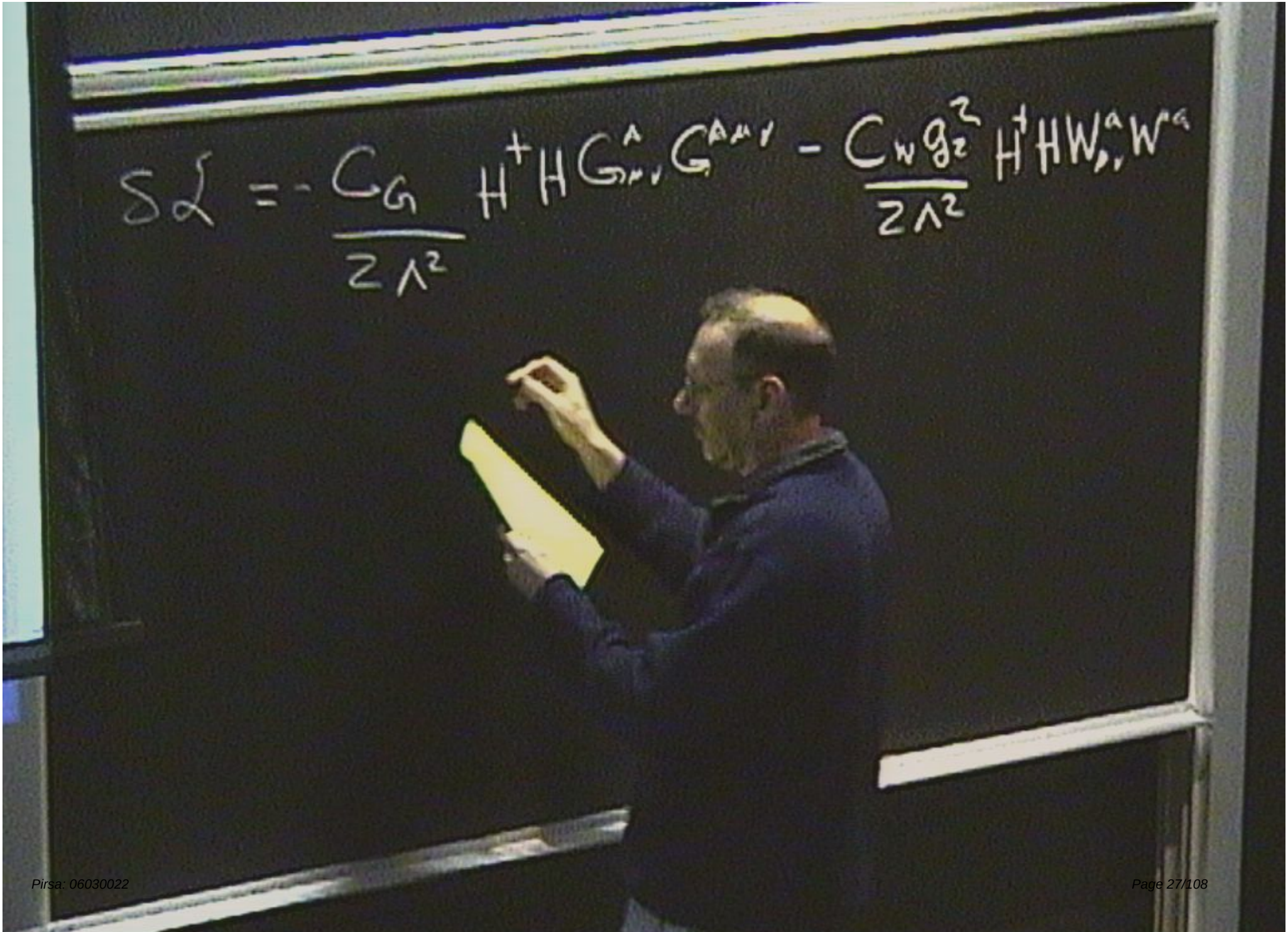

h
Z
Z*
l
l
$M_{Pl} \sim 10^{19}$ GeV
$M_{GUT} \sim 10^{16}$ GeV
$\rightarrow M \sim 1$ TeV
$\delta M_h^2 \sim \frac{g^2 \Lambda_{cut}^2}{16\pi^2}$
$\mathcal{L} \sim \Lambda^4 \sqrt{g} \sim \Lambda^4 (1 + h^n)$
$\Lambda \sim 10^{-3}$ eV
$\Lambda^4 \sim \frac{\Lambda_{cut}^4}{16\pi^2}$


≈ 10⁶ higgs
30 fb⁻¹ ~ 3 years
W
W
h
h
Br ≈ 0,22%


h
Z
Z*
l
l
$M_{Pl} \sim 10^{19}$ GeV
$M_{GUT} \sim 10^{16}$ GeV
$M \sim 1$ TeV
h
h
$\delta M_h^2 \sim \frac{g_{SM}^2 \Lambda_{cut}^2}{16\pi^2}$
$\Lambda \sqrt{g} \sim \Lambda (1 + \frac{h}{M})$
$\Lambda \sim 10^{17}$ eV
$\Lambda^4 \sim \frac{\Lambda_{cut}^4}{16\pi^2}$


hep-ph/0601212
q
q
h
q
W
h
q
≈ 10⁶ higgs
30 fb⁻¹ ~ 3 years
W
γ
h
γ
t
γ
h
t
γ
Br ≈ 0,22%


$\delta\mathcal{L} = -\frac{C_G}{2\Lambda^2} H^\dagger H$

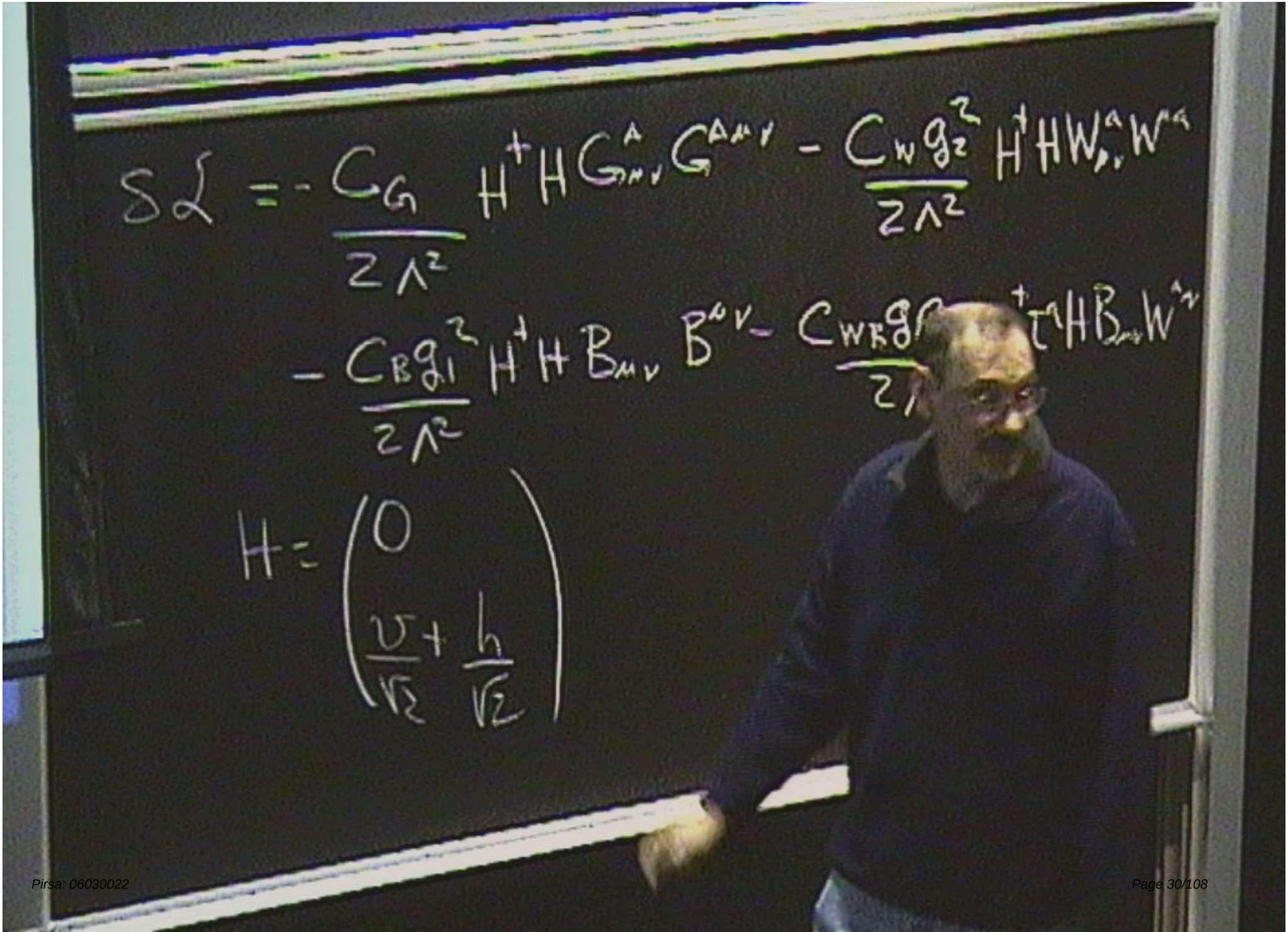

$\delta\mathcal{L} = -\frac{C_G}{2\Lambda^2} H^\dagger H G^a_{\mu\nu} G^{a\mu\nu} - \frac{C_W g_2^3}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$

$$\delta\mathcal{L} = -\frac{C_G}{2\Lambda^2} H^\dagger H G^A_{\mu\nu} G^{A\mu\nu} - \frac{C_W g_2^2}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$$

$$- \frac{C_B g_1^2}{2\Lambda^2} H^\dagger H$$

$$\delta\mathcal{L} = -\frac{C_G}{2\Lambda^2} H^\dagger H G^A_{\mu\nu} G^{A\mu\nu} - \frac{C_W g_2^2}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$$

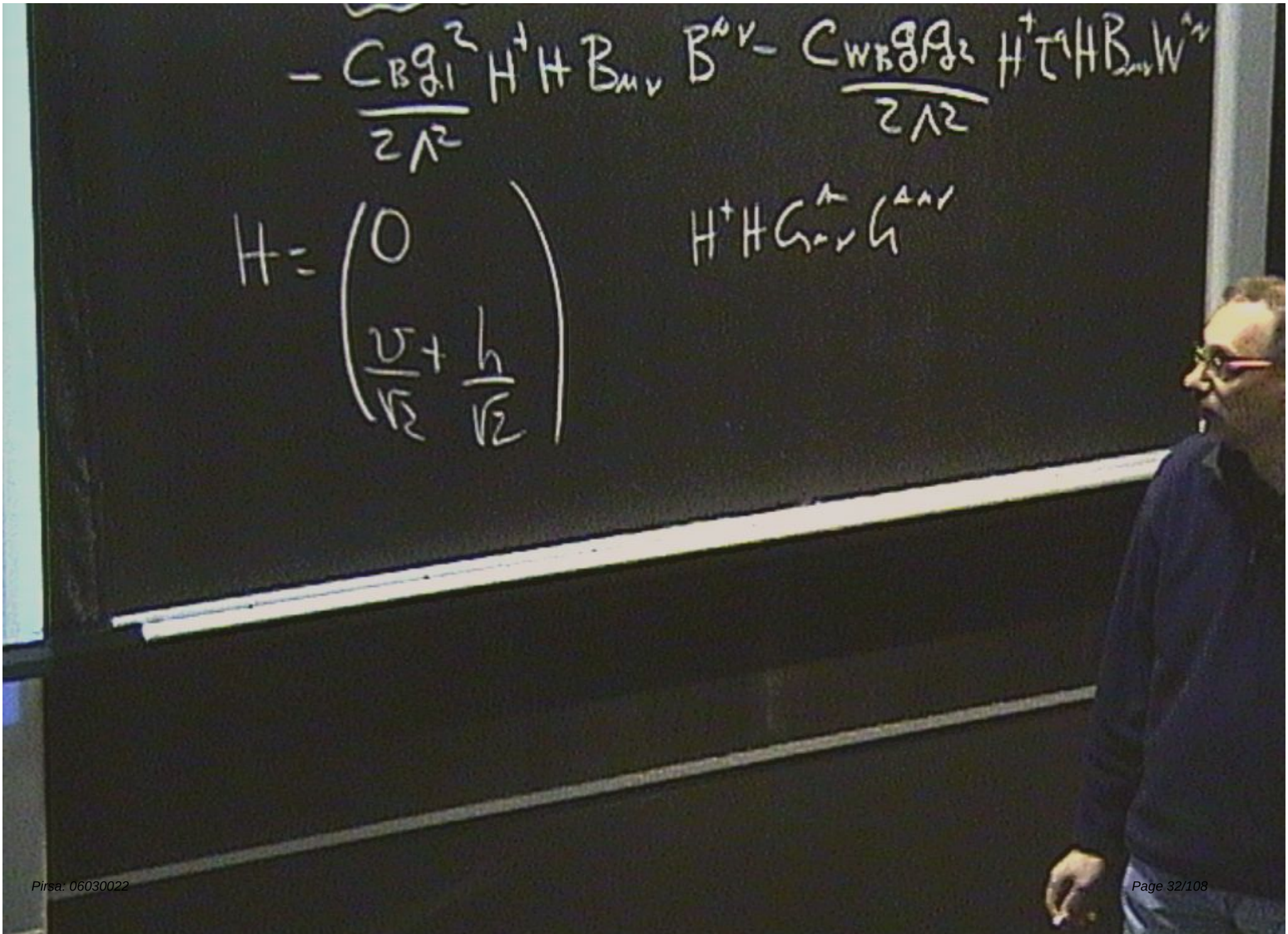
$$- \frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - \frac{C_{WB} g g_2}{2\Lambda^2} H^\dagger \tau^a H B_{\mu\nu} W^{a\mu\nu}$$

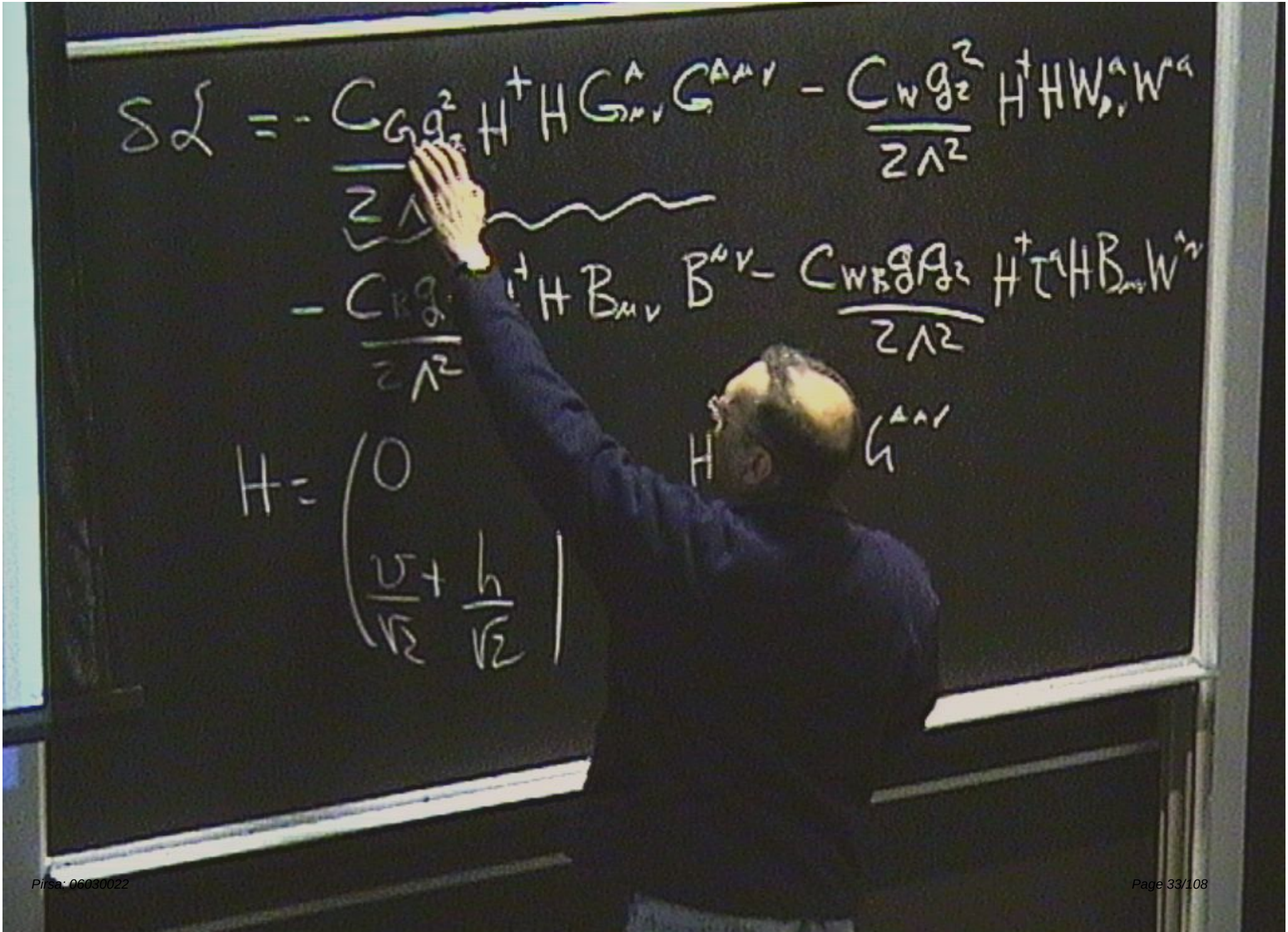

$\delta\mathcal{L} = -\frac{C_G}{2\Lambda^2} H^\dagger H G^a_{\mu\nu} G^{a\mu\nu} - \frac{C_W g_2^2}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$
$- \frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - C_{WB} g$
$H = \begin{pmatrix} 0 \\ \frac{v}{\sqrt{2}} + \frac{h}{\sqrt{2}} \end{pmatrix}$

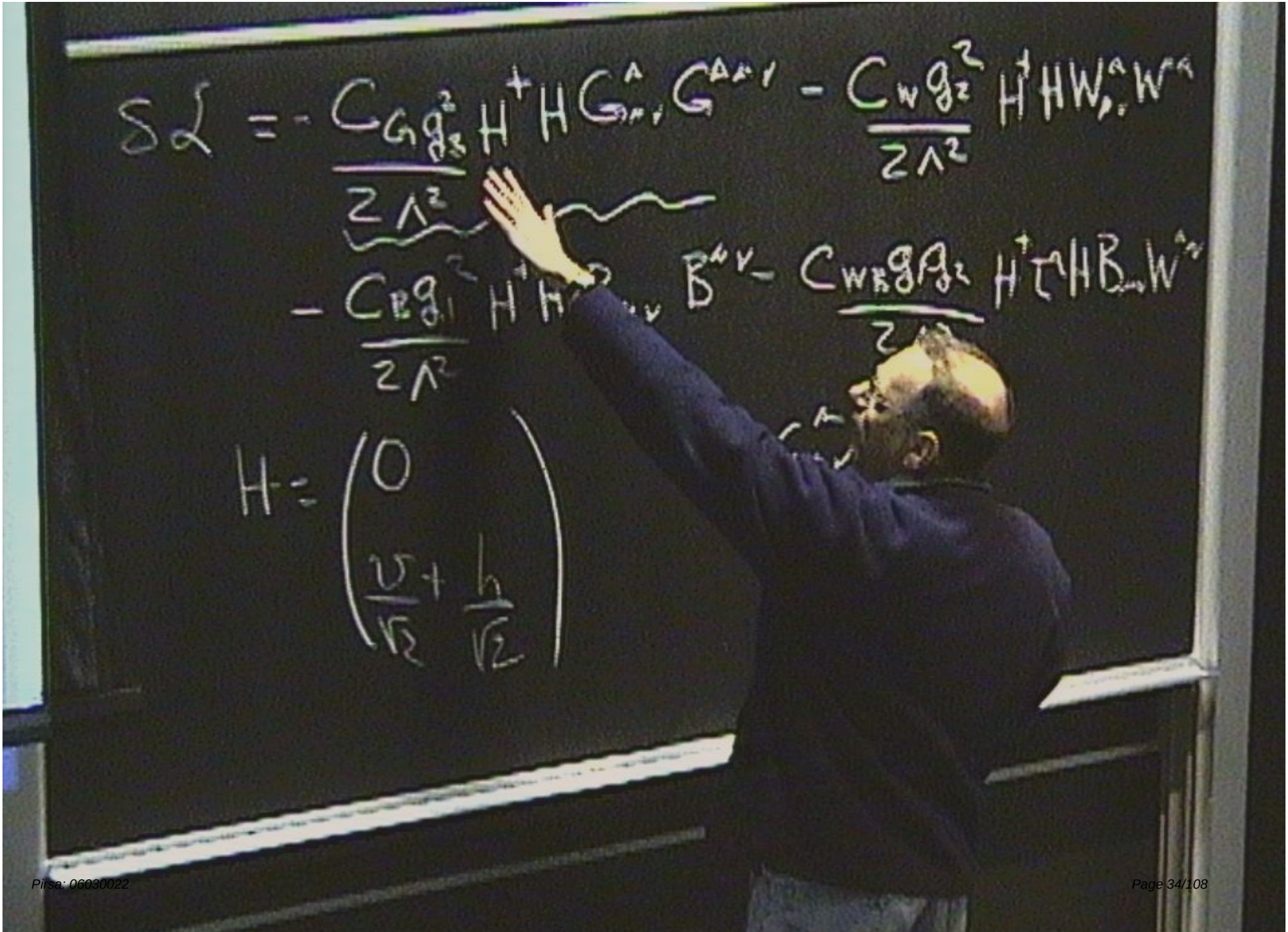
$$\delta\mathcal{L} = -\frac{C_G}{2\Lambda^2} H^\dagger H G^A_{\mu\nu} G^{A\mu\nu} - \frac{C_W g_2^2}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$$

$$- \frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - \frac{C_{WB} g_1 g_2}{2\Lambda^2} H^\dagger \tau^a H B_{\mu\nu} W^{a\mu\nu}$$

$$H = \begin{pmatrix} 0 \\ \frac{v}{\sqrt{2}} + \frac{h}{\sqrt{2}} \end{pmatrix}$$


$-\frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - \frac{C_{WB} g g_2}{2\Lambda^2} H^\dagger \tau^I H B_{\mu\nu} W^{\mu\nu}$
$H = \begin{pmatrix} 0 \\ \frac{v}{\sqrt{2}} + \frac{h}{\sqrt{2}} \end{pmatrix}$
$H^\dagger H G^a_{\mu\nu} G^{a\mu\nu}$


$\delta\mathcal{L} = -\frac{C_G g_s^2}{2\Lambda^2} H^\dagger H G^a_{\mu\nu} G^{a\mu\nu} - \frac{C_W g_2^2}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$
$- \frac{C_B g'^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - \frac{C_{WB} g g_2}{2\Lambda^2} H^\dagger \tau^a H B_{\mu\nu} W^{a\mu\nu}$
$H = \begin{pmatrix} 0 \\ \frac{v}{\sqrt{2}} + \frac{h}{\sqrt{2}} \end{pmatrix}$
H
$G^{a\mu\nu}$


$\delta\mathcal{L} = -\frac{C_G g_s^2}{2\Lambda^2} H^\dagger H G^a_{\mu\nu} G^{a\mu\nu} - \frac{C_W g_2^2}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$
$- \frac{C_B g_1^2}{2\Lambda^2} H^\dagger H$
$B^{\mu\nu}$
$- C_{WB} g g_2$
$H^\dagger \tau^a H B_{\mu\nu} W^{a\mu\nu}$
$H = \begin{pmatrix} 0 \\ \frac{v}{\sqrt{2}} + \frac{h}{\sqrt{2}} \end{pmatrix}$

$$\delta\mathcal{L} = -\frac{C_G g_3^2}{2\Lambda^2} H^\dagger H G^A_{\mu\nu} G^{A\mu\nu} - \frac{C_W g_2^2}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$$

$$- \frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - \frac{C_{WB} g_1 g_2}{2\Lambda^2} H^\dagger \tau^a H B_{\mu\nu} W^{a\mu\nu}$$

$$H = \begin{pmatrix} 0 \\ \frac{v}{\sqrt{2}} + \frac{h}{\sqrt{2}} \end{pmatrix}$$

$$H^\dagger H G^A_{\mu\nu} G^{A\mu\nu}$$

$$\delta\mathcal{L} = -\frac{C_G g_3^2}{2\Lambda^2} H^\dagger H G^a_{\mu\nu} G^{a\mu\nu} - \frac{C_W g_2^2}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$$

$$- \frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - \frac{C_{WB} g_1 g_2}{2\Lambda^2} H^\dagger \tau^a H B_{\mu\nu} W^{a\mu\nu}$$

$$H = \begin{pmatrix} 0 \\ \frac{v}{\sqrt{2}} + \frac{h}{\sqrt{2}} \end{pmatrix}$$

$$H^\dagger H G^a_{\mu\nu} G^{a\mu\nu}$$

$$\rightarrow \frac{v^2}{2} G^a_{\mu\nu} G^{a\mu\nu} + v^2 h$$

$$\delta\mathcal{L} = -\frac{C_G g_3^2}{2\Lambda^2} H^\dagger H G^A_{\mu\nu} G^{A\mu\nu} - \frac{C_W g_2^2}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$$

$$- \frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - \frac{C_{WB} g_1 g_2}{2\Lambda^2} H^\dagger \tau^a H B_{\mu\nu} W^{a\mu\nu}$$

$$H = \begin{pmatrix} 0 \\ \frac{v}{\sqrt{2}} + \frac{h}{\sqrt{2}} \end{pmatrix}$$

$$H^\dagger H G^A_{\mu\nu} G^{A\mu\nu}$$

$$\rightarrow \frac{v^2}{2} G^A_{\mu\nu} G^{A\mu\nu} + \frac{v^2 h}{} G^A_{\mu\nu}$$

$$\delta\mathcal{L} = -\frac{C_G g_3^2}{2\Lambda^2} H^\dagger H G^A_{\mu\nu} G^{A\mu\nu} - \frac{C_W g_2^2}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$$

$$- \frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - \frac{C_{WB} g_1 g_2}{2\Lambda^2} H^\dagger \tau^a H B_{\mu\nu} W^{a\mu\nu}$$

$$H = \begin{pmatrix} 0 \\ \frac{v}{\sqrt{2}} + \frac{h}{\sqrt{2}} \end{pmatrix}$$

TeV

$$H^\dagger H G^A_{\mu\nu} G^{A\mu\nu}$$

$$\rightarrow \frac{v^2}{2} G^A_{\mu\nu} G^{A\mu\nu} + \frac{v h}{\Lambda^2} G^A_{\mu\nu}$$

$$\delta\mathcal{L} = -\frac{C_G g_3^2}{2\Lambda^2} H^\dagger H G^A_{\mu\nu} G^{A\mu\nu} - \frac{C_W g_2^2}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$$

$$- \frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - \frac{C_{WB} g_1 g_2}{2\Lambda^2} H^\dagger \tau^a H B_{\mu\nu} W^{a\mu\nu}$$

$$H = \begin{pmatrix} 0 \\ \frac{1}{\sqrt{2}}(v+h) \end{pmatrix}$$

$\Lambda \sim 1\,\text{TeV}$

$$H^\dagger H G^A_{\mu\nu} G^{A\mu\nu}$$

$$\rightarrow \frac{v^2}{2} G^A_{\mu\nu} G^{A\mu\nu} + v h G^A_{\mu\nu}$$

$$\delta\mathcal{L} = -\frac{C_G g_3^2}{2\Lambda^2} H^\dagger H G^A_{\mu\nu} G^{A\mu\nu} - \frac{C_W g_2^2}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$$

$$- \frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - \frac{C_{WB} g_1 g_2}{2\Lambda^2} H^\dagger \tau^a H B_{\mu\nu} W^{a\mu\nu}$$

$$H = \begin{pmatrix} 0 \\ \frac{v+h}{\sqrt{2}} \end{pmatrix}$$

$\Lambda \sim 1\,\text{TeV}$

$$H^\dagger H G^A_{\mu\nu} G^{A\mu\nu}$$

$$\rightarrow \frac{v^2}{2} G^A_{\mu\nu} G^{A\mu\nu} + \frac{v h}{\sqrt{2}} G^A_{\mu\nu}$$

$$\delta\mathcal{L} = -\frac{C_G g_3^2}{2\Lambda^2} H^\dagger H G^A_{\mu\nu} G^{A\mu\nu} - \frac{C_W g_2^2}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$$

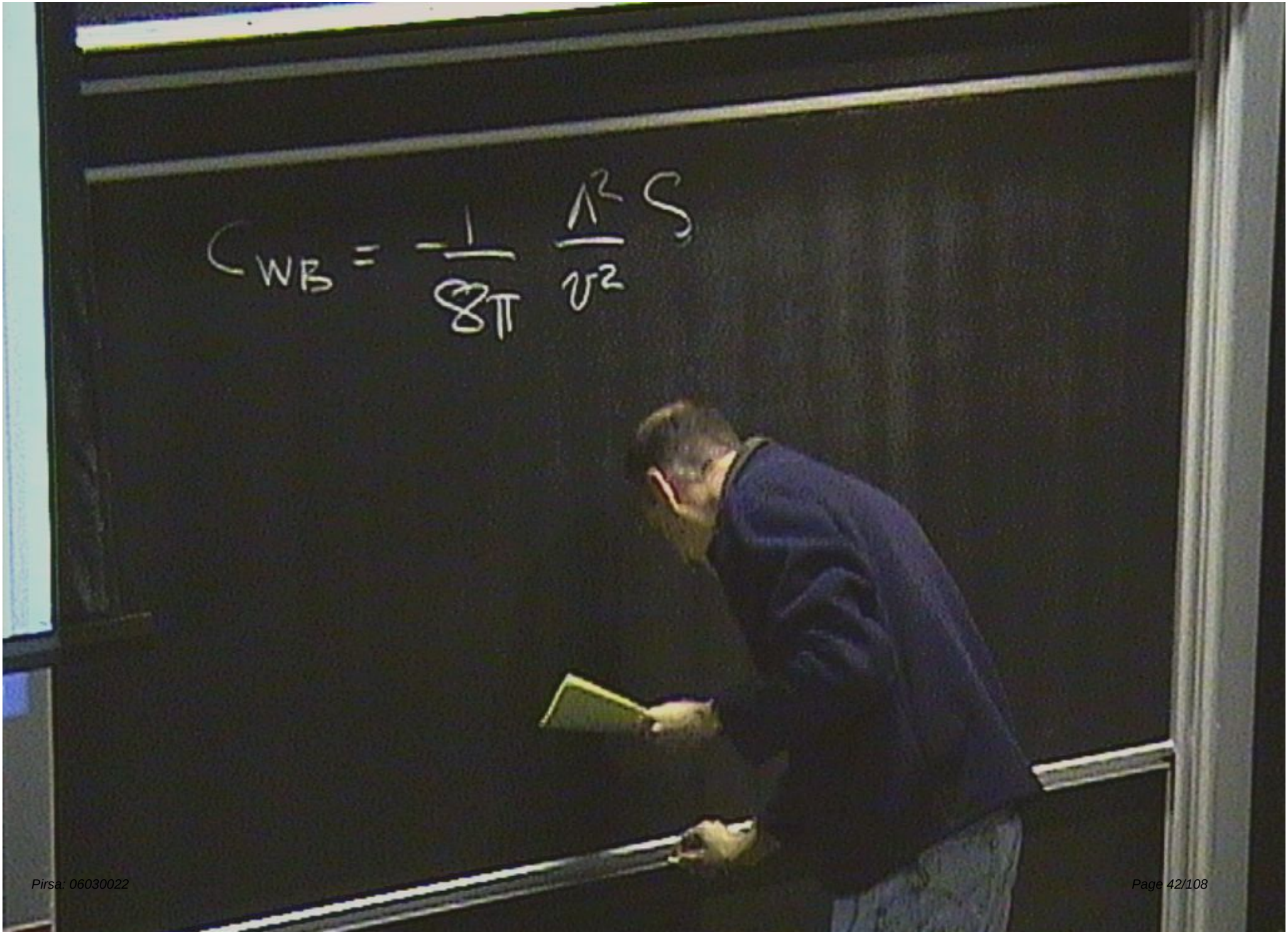
$$- \frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - \frac{C_{WB} g_1 g_2}{2\Lambda^2} H^\dagger \tau^a H B_{\mu\nu} W^{a\mu\nu}$$

$$H = \begin{pmatrix} 0 \\ \frac{v}{\sqrt{2}} + \frac{h}{\sqrt{2}} \end{pmatrix}$$

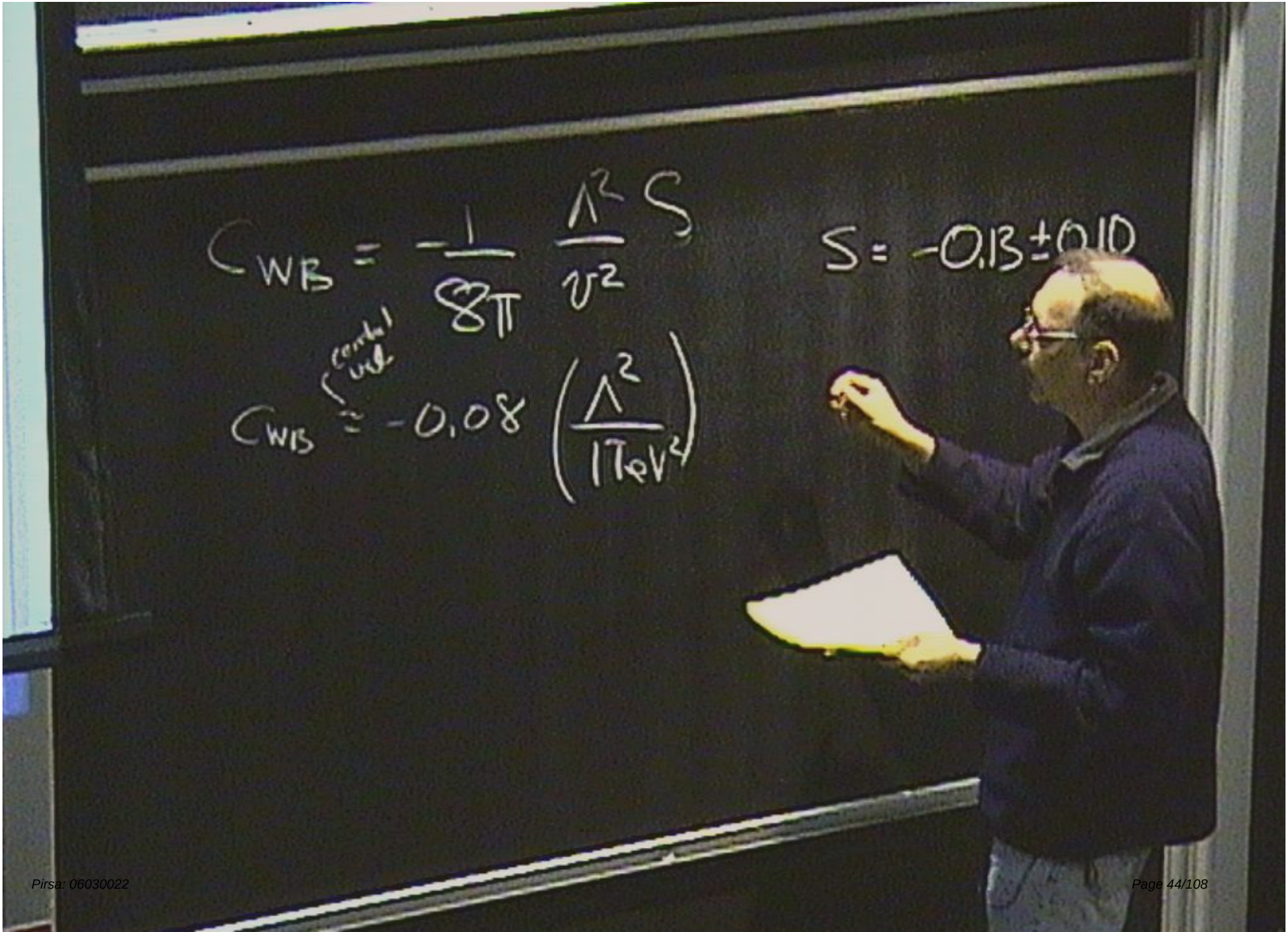
$\Lambda \sim 1\,\text{TeV}$

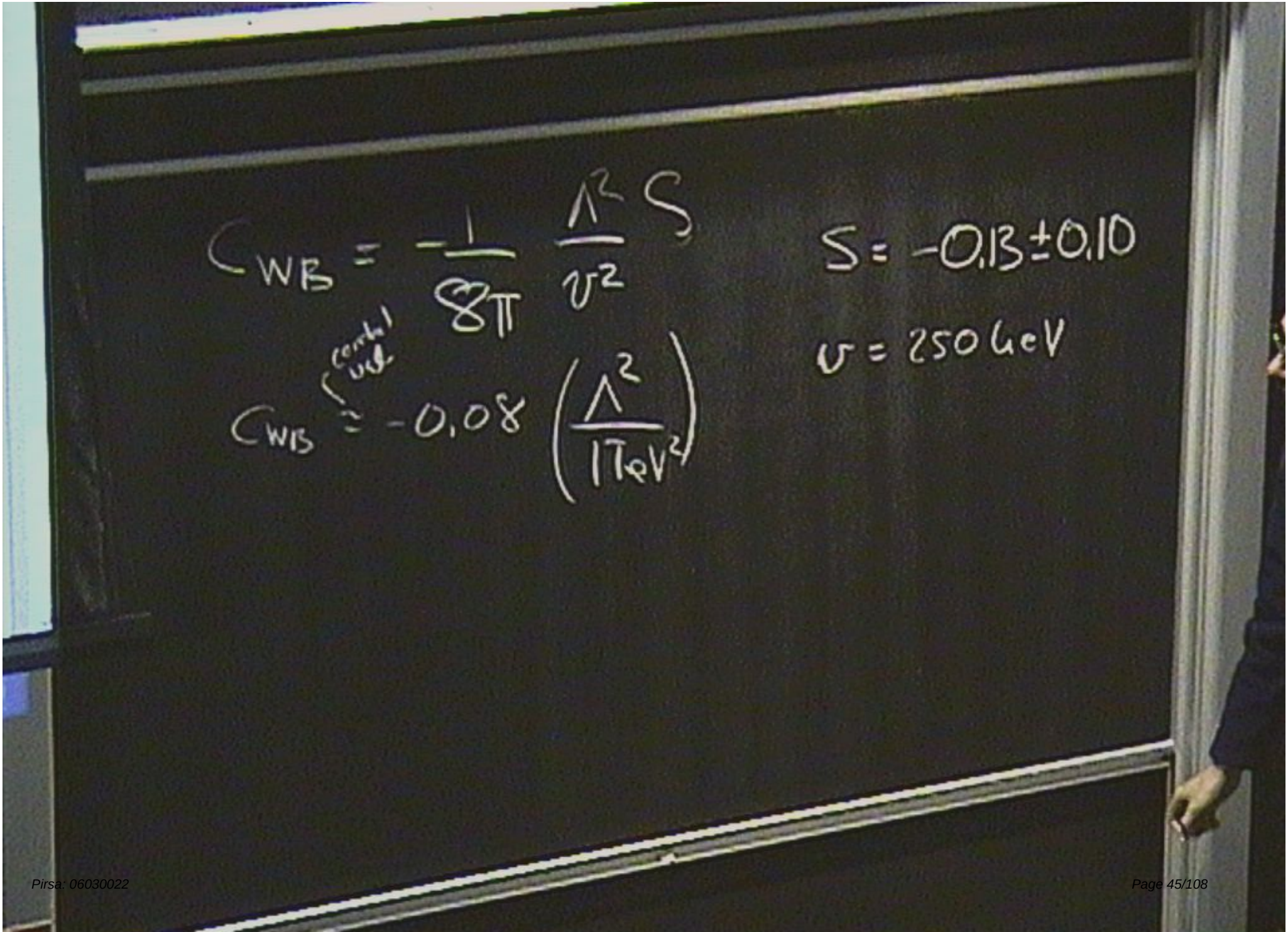
$$H^\dagger H G^A_{\mu\nu} G^{A\mu\nu}$$

$$\rightarrow \frac{v^2}{2} G^A_{\mu\nu} G^{A\mu\nu} + \frac{v h}{f} G^A_{\mu\nu}$$


$C_{WB} = \frac{-1}{8\pi} \frac{\Lambda^2}{v^2} S$

$$C_{WB} = -\frac{1}{8\pi}\frac{\Lambda^2}{v^2}S \qquad S = -0.13 \pm 0.10$$


$C_{WB} = -\frac{1}{8\pi}\frac{\Lambda^2}{v^2} S$
$S = -0.13 \pm 0.10$
(central value)
$C_{WB} \simeq -0.08 \left(\frac{\Lambda^2}{1\,\mathrm{TeV}^2}\right)$


$C_{WB} = -\frac{1}{8\pi}\frac{\Lambda^2}{v^2}S$
$S = -0.13 \pm 0.10$
$v = 250\,GeV$
(central value)
$C_{WB} \simeq -0.08\left(\frac{\Lambda^2}{1\,TeV^2}\right)$

$$C_{WB} = -\frac{1}{8\pi}\frac{\Lambda^2}{v^2} S$$

$$S = -0.13 \pm 0.10$$

$$v = 250\ \text{GeV}$$

$$C_{WB} \overset{\text{(central value)}}{\simeq} -0.08 \left(\frac{\Lambda^2}{1\ \text{TeV}^2}\right)$$

$2\Lambda^2$ $\qquad$ $2\Lambda^2$

$$-\frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - \frac{C_{WB} g g_2}{2\Lambda^2} H^\dagger \tau^i H B_{\mu\nu} W^{i\mu\nu}$$

$$H^\dagger H G^a_{\mu\nu} G^{a\mu\nu}$$

$$H = \begin{pmatrix} 0 \\ \frac{v}{\sqrt{2}} + \frac{h}{\sqrt{2}} \end{pmatrix}$$

$\Lambda \sim 1\,\text{TeV}$

$$\rightarrow \frac{v^2}{2} G^a_{\mu\nu} G^{a\mu\nu} + v h G^a_{\mu\nu}$$

$$C_{WB} = -\frac{1}{2} \frac{\Lambda^2}{m_W^2} S \qquad S = -0.13 \pm 0.10$$

$$C_{WB} = -\frac{1}{8\pi}\frac{\Lambda^2}{v^2} S$$

$$S = -0.13 \pm 0.10$$

$$v = 250\ \text{GeV}$$

(central val.)

$$C_{WB} \simeq -0.08 \left(\frac{\Lambda^2}{1\,\text{TeV}^2}\right)$$

$$C_{WB} = -\frac{1}{8\pi}\frac{\Lambda^2}{v^2} S$$

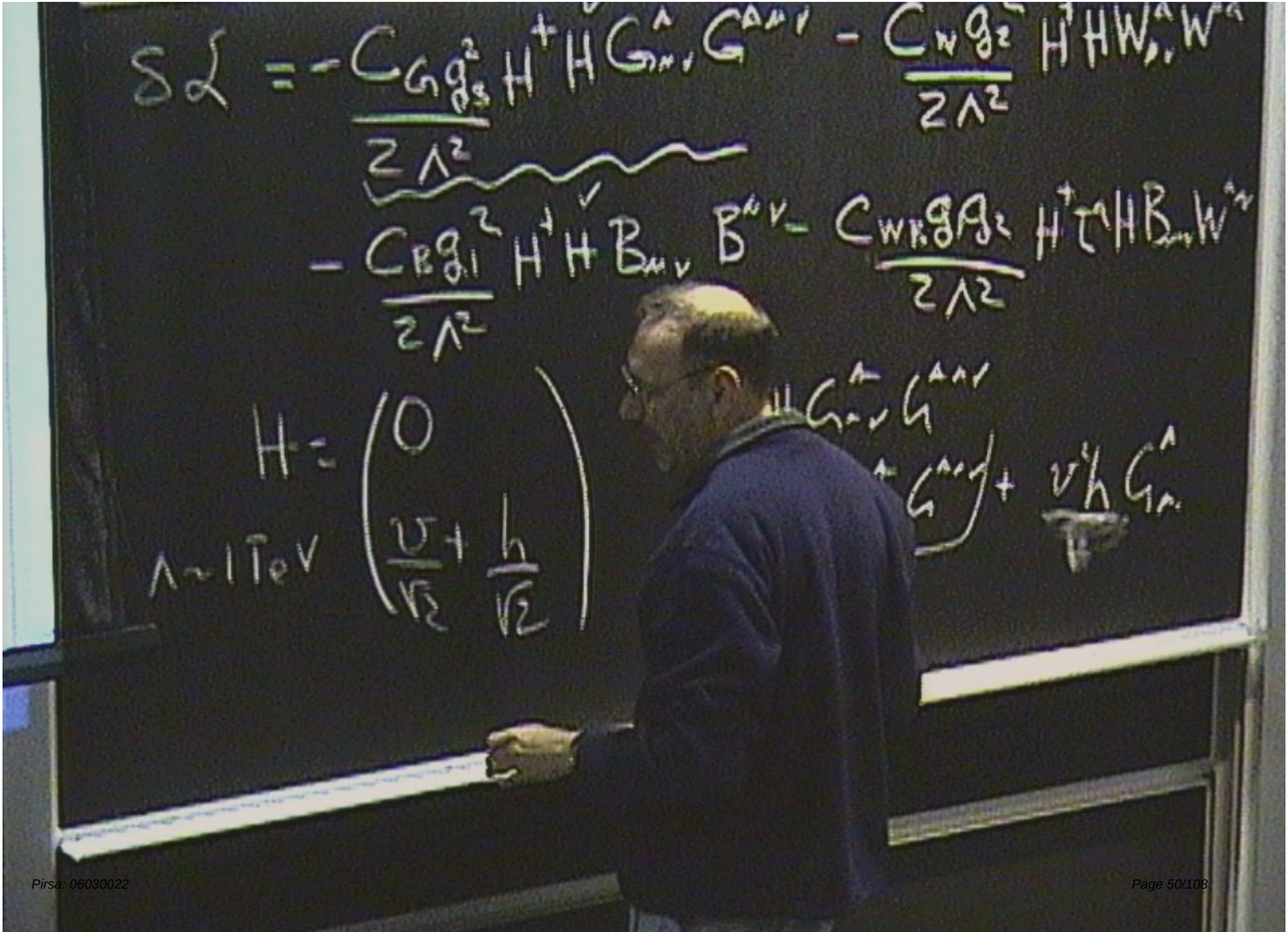
$S = -0.13 \pm 0.10$

$v = 250\ \text{GeV}$

(central val.)

$$C_{WB} \simeq -0.08 \left(\frac{\Lambda^2}{1\,\text{TeV}^2}\right)$$

C_q


$\delta\mathcal{L} = -\frac{C_G g_s^2}{2\Lambda^2} H^\dagger H G_{\mu\nu} G^{\mu\nu} - \frac{C_W g_2^2}{2\Lambda^2} H^\dagger H W_{\mu\nu} W^{\mu\nu}$
$- \frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - \frac{C_{WB} g_1 g_2}{2\Lambda^2} H^\dagger \tau^a H B_{\mu\nu} W^{a\mu\nu}$
$H = \begin{pmatrix} 0 \\ \frac{v+h}{\sqrt{2}} \end{pmatrix}$
$\Lambda \sim 1\,\text{TeV}$
$G_{\mu\nu} G^{\mu\nu}$
$G^{\mu\nu} J + \frac{v}{\Lambda} h G_{\mu\nu}$

$$C_{WB} = -\frac{1}{8\pi}\frac{\Lambda^2}{v^2} S$$

$$S = -0.13 \pm 0.10$$

$$v = 250\ \text{GeV}$$

$$C_{WB} \simeq -0.08 \left(\frac{\Lambda^2}{1\,\text{TeV}^2}\right)$$

(central val.)

C_q

$$C_{WB} = -\frac{1}{8\pi}\frac{\Lambda^2}{v^2} S$$

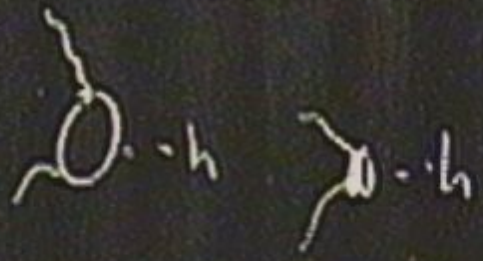
$$S = -0.13 \pm 0.10$$

$v = 250\ \mathrm{GeV}$

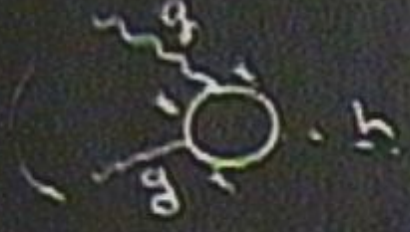
(central value)

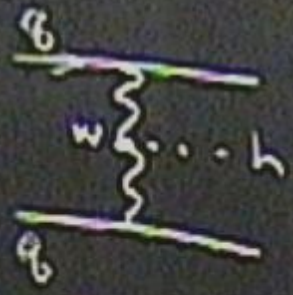
$$C_{WB} \simeq -0.08 \left(\frac{\Lambda^2}{1\,\mathrm{TeV}^2}\right)$$

C_G

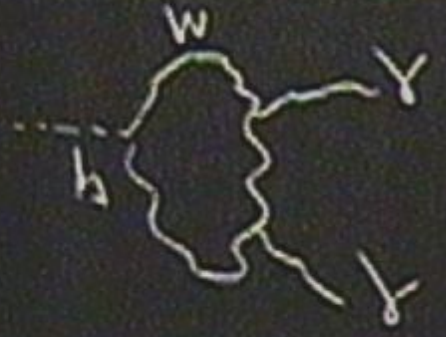


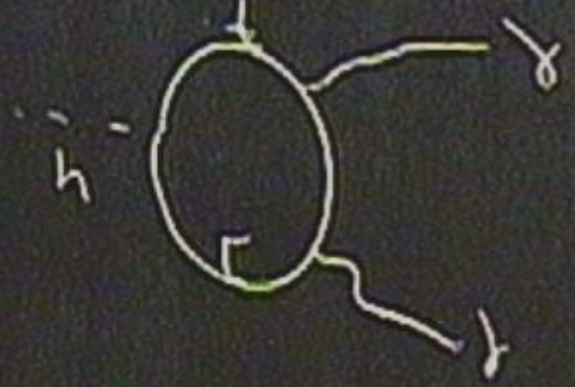
hep-ph/0601212



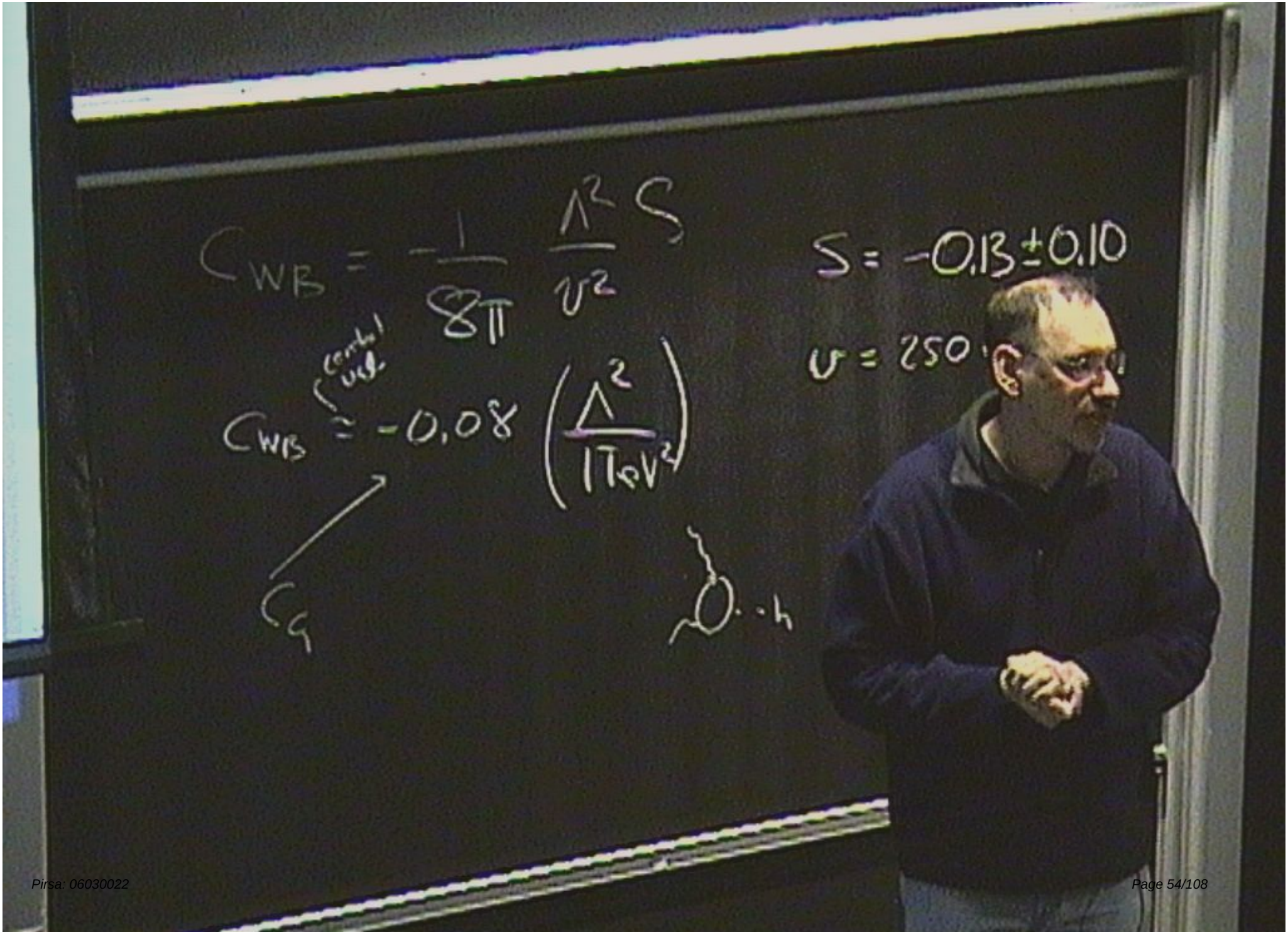


$\sim 10^4$ higgs
$30\,\text{fb}^{-1}$ ~ 3 years





$Br \sim 0.122\%$


$C_{WB} = -\frac{1}{8\pi}\frac{\Lambda^2}{v^2} S$
$S = -0.13 \pm 0.10$
$v = 250$
(central val.)
$C_{WB} \simeq -0,08 \left(\frac{\Delta^2}{1\,TeV^2}\right)$
C_G
~ 0.4

$$C_{WB} = -\frac{1}{8\pi}\frac{\Lambda^2}{v^2} S$$

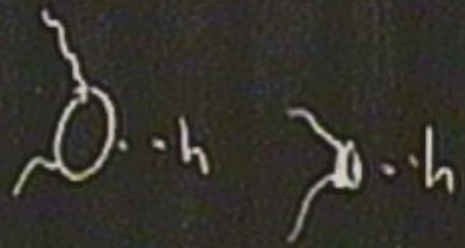
$$S = -0.13 \pm 0.10$$

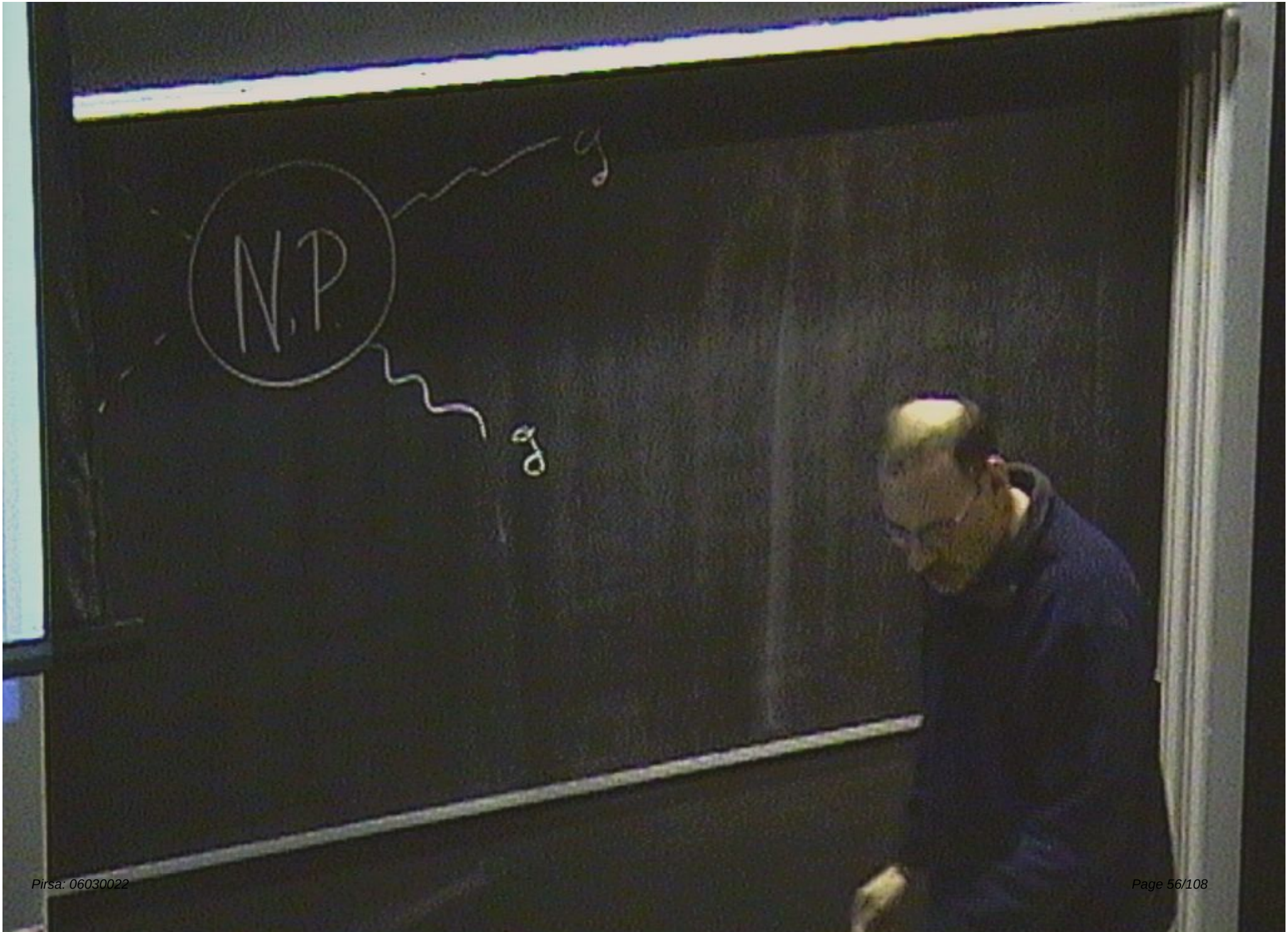
$$v = 250\ \text{GeV}$$

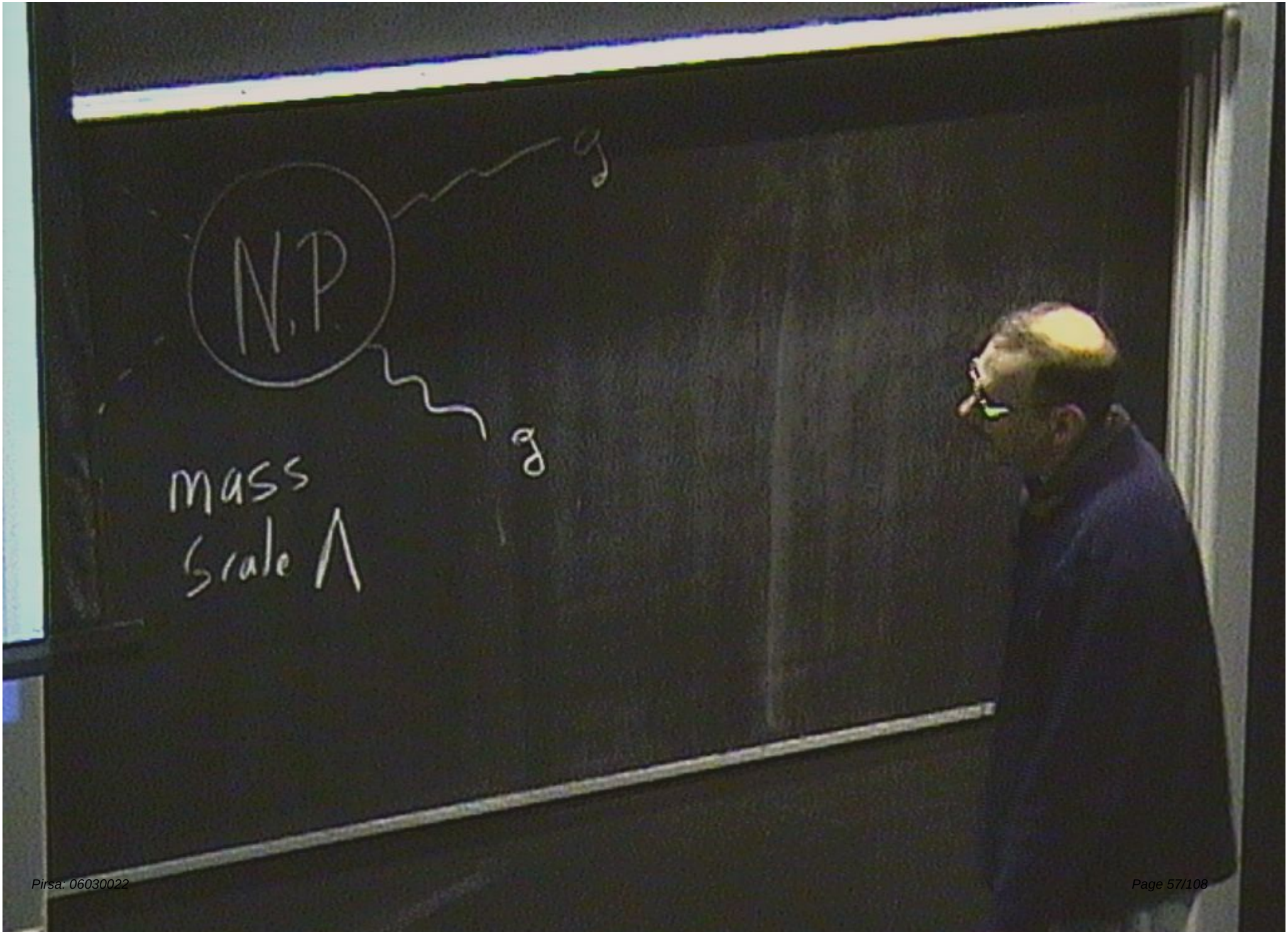
(central val.)

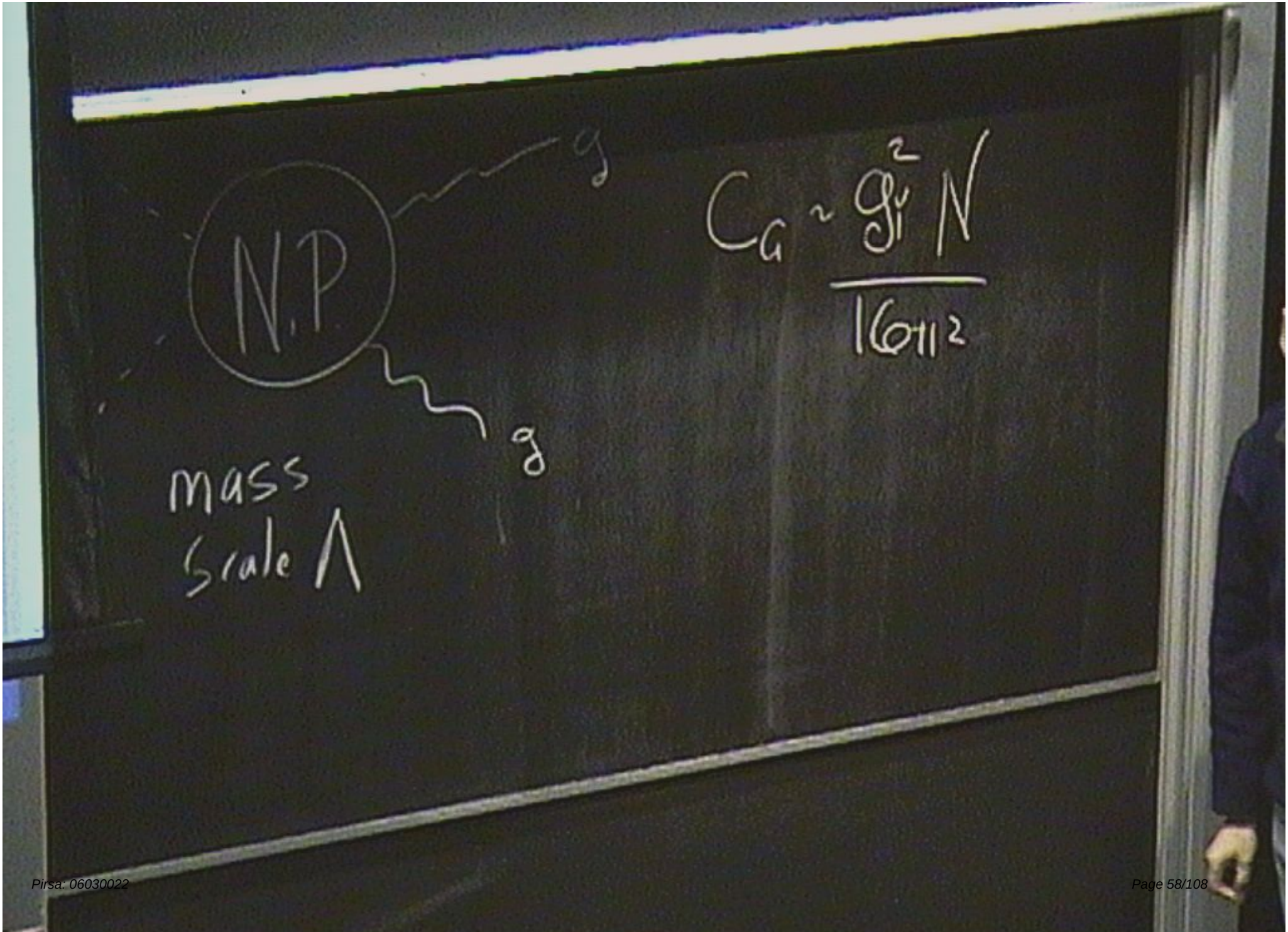
$$C_{WB} \simeq -0,08 \left(\frac{\Lambda^2}{1\,\text{TeV}^2}\right)$$

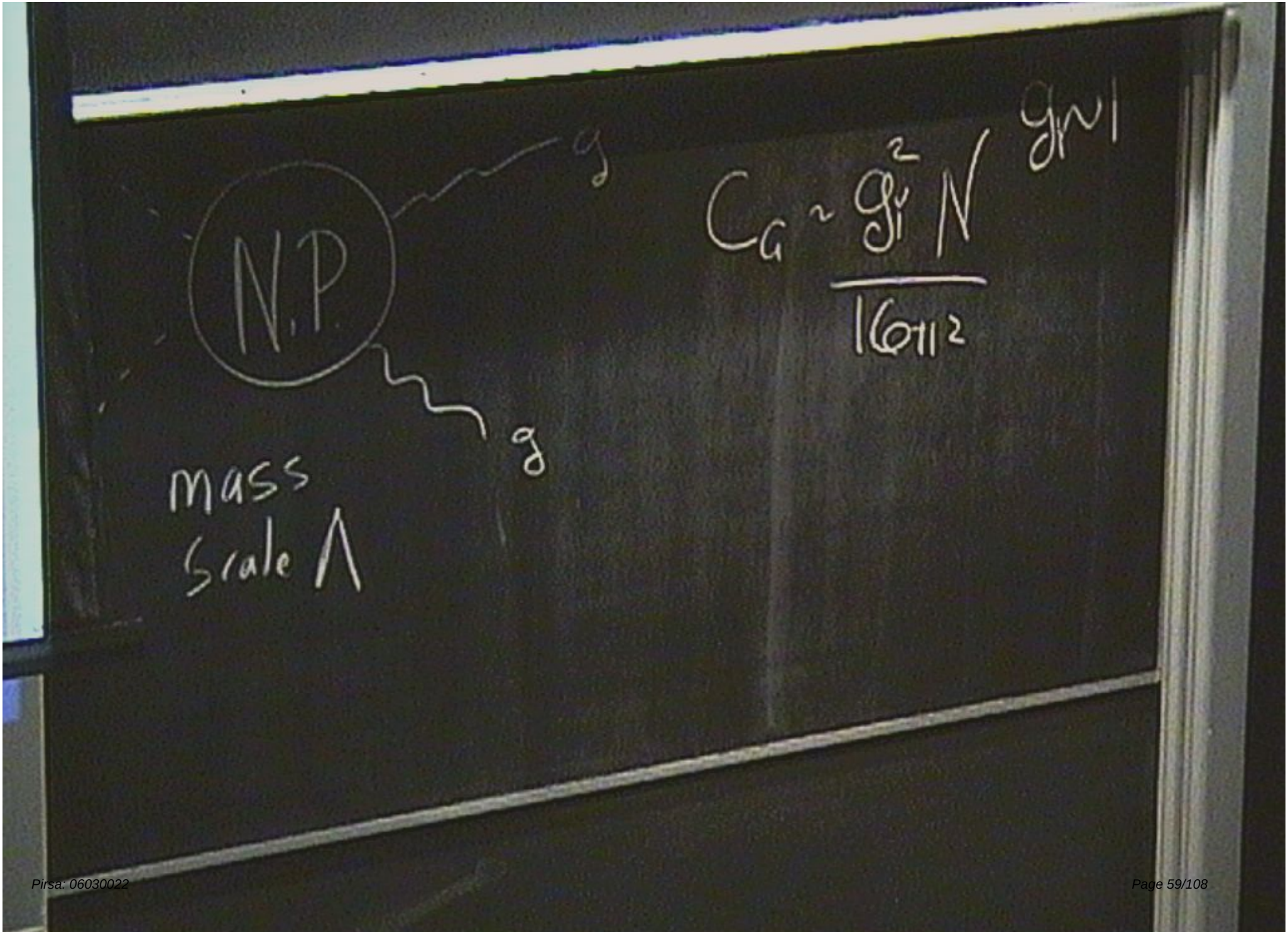
C_q

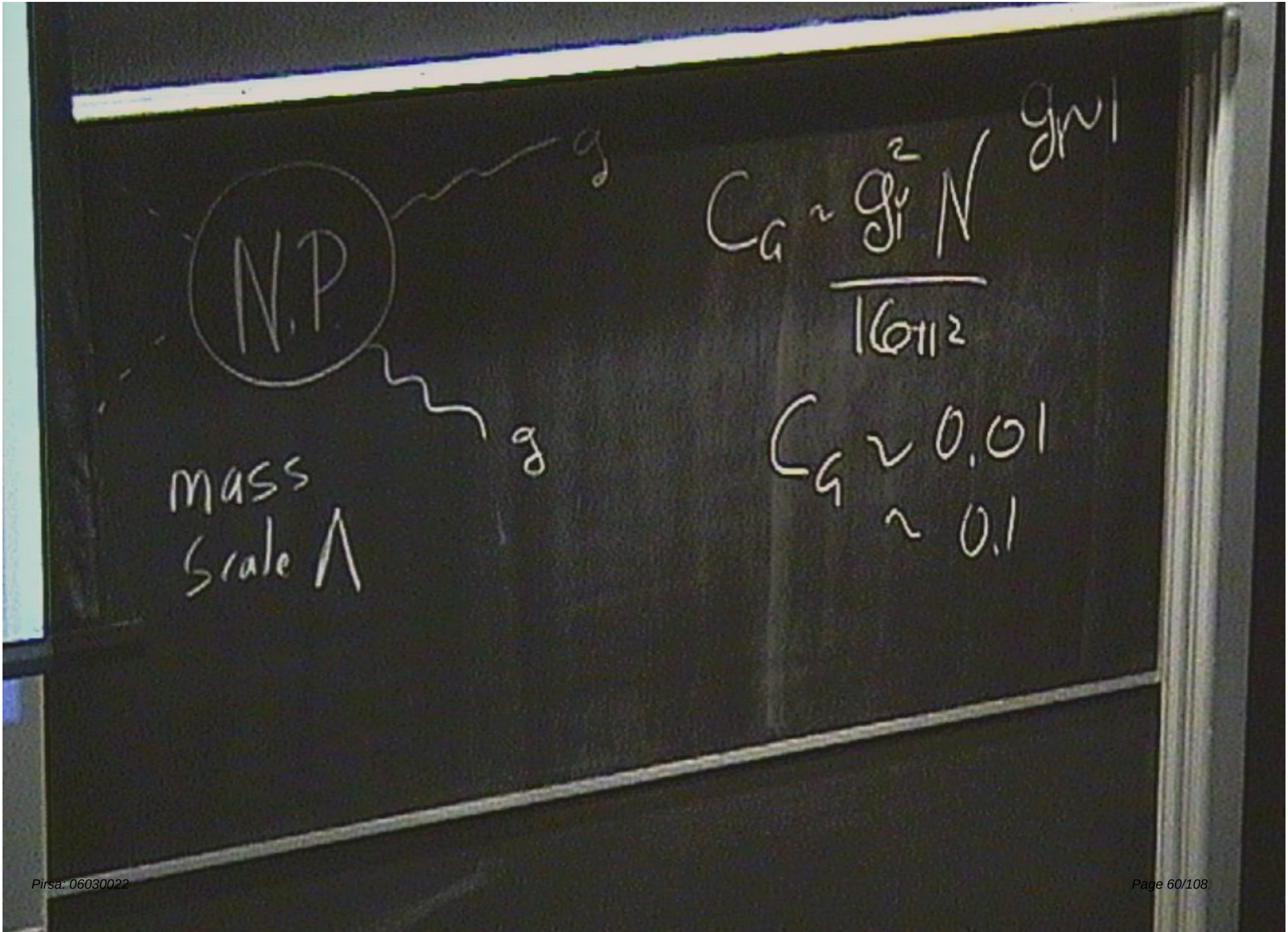


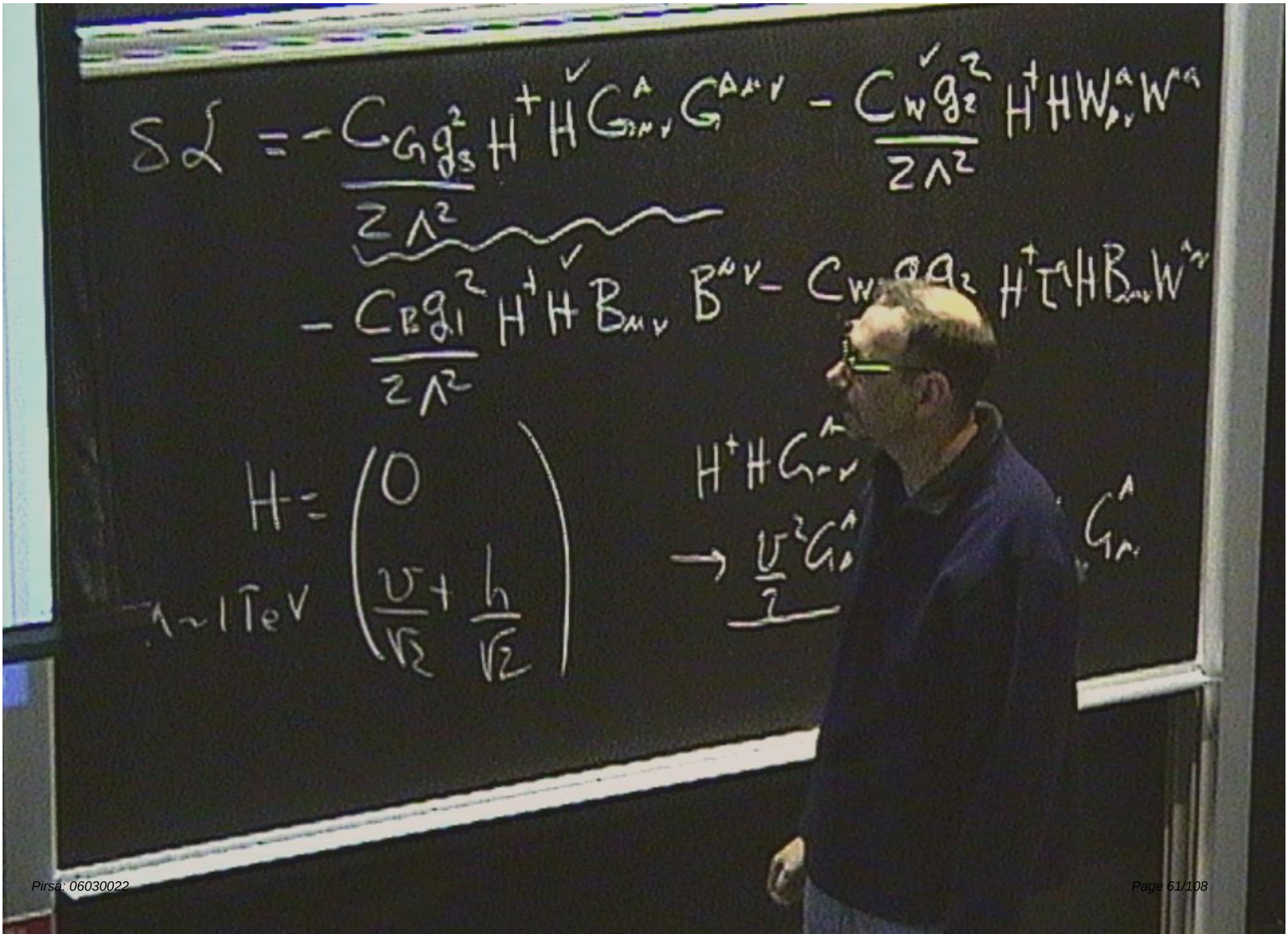

N.P.
g
g

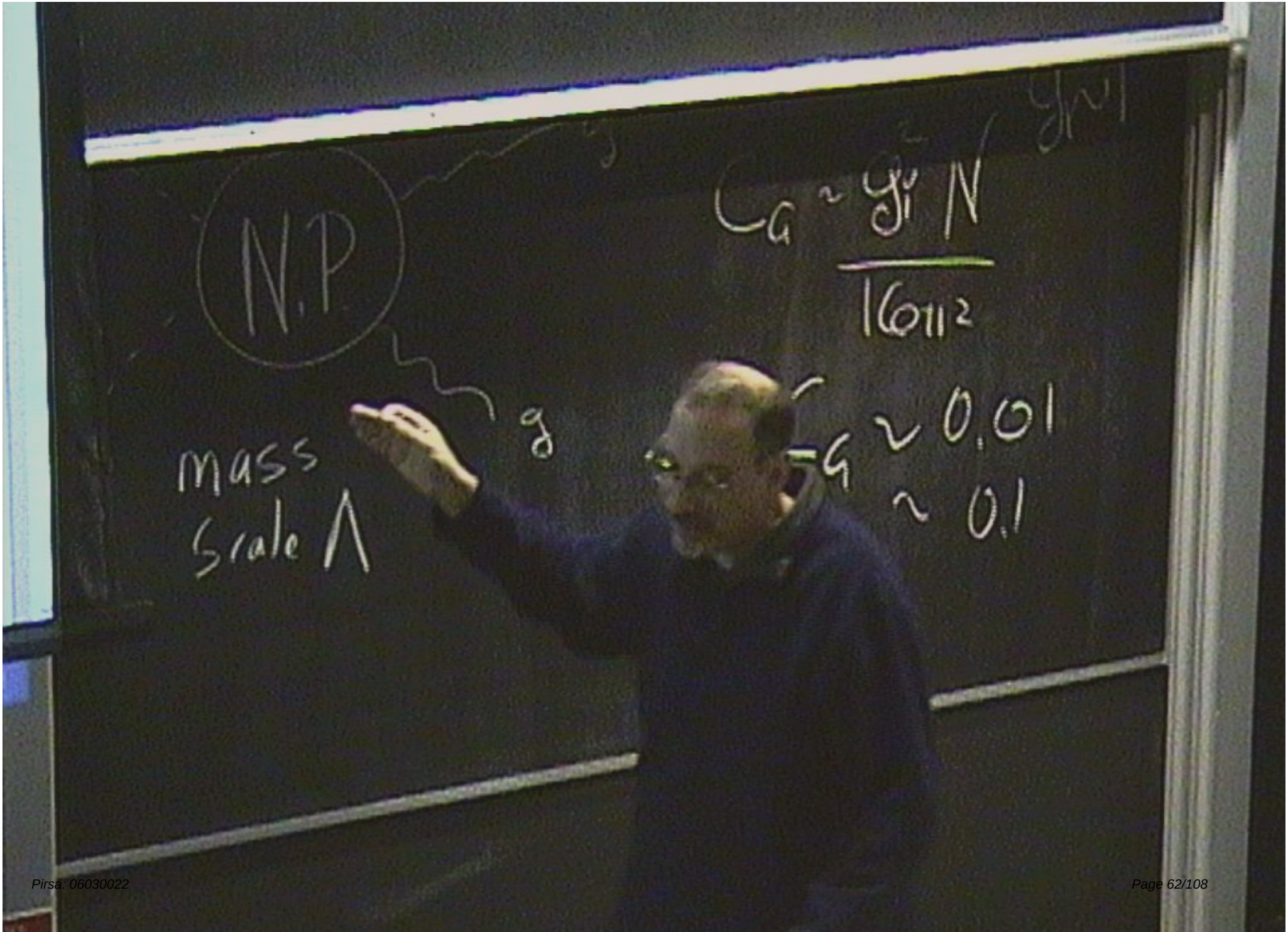

N.P
g
g
mass
Scale Λ

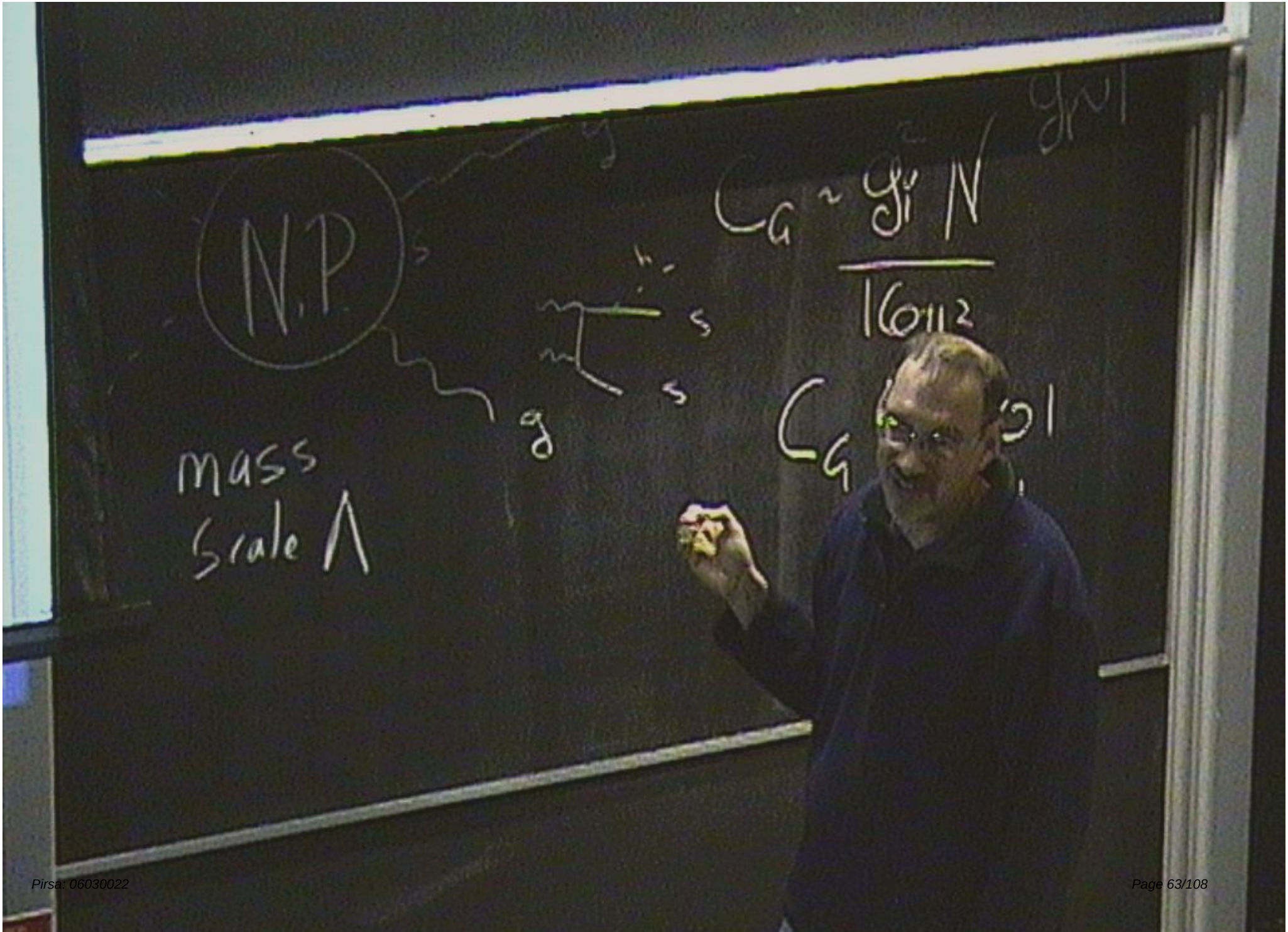

N.P
g
g
mass
Scale Λ
$C_a \sim \frac{g_i^2 N}{16\pi^2}$

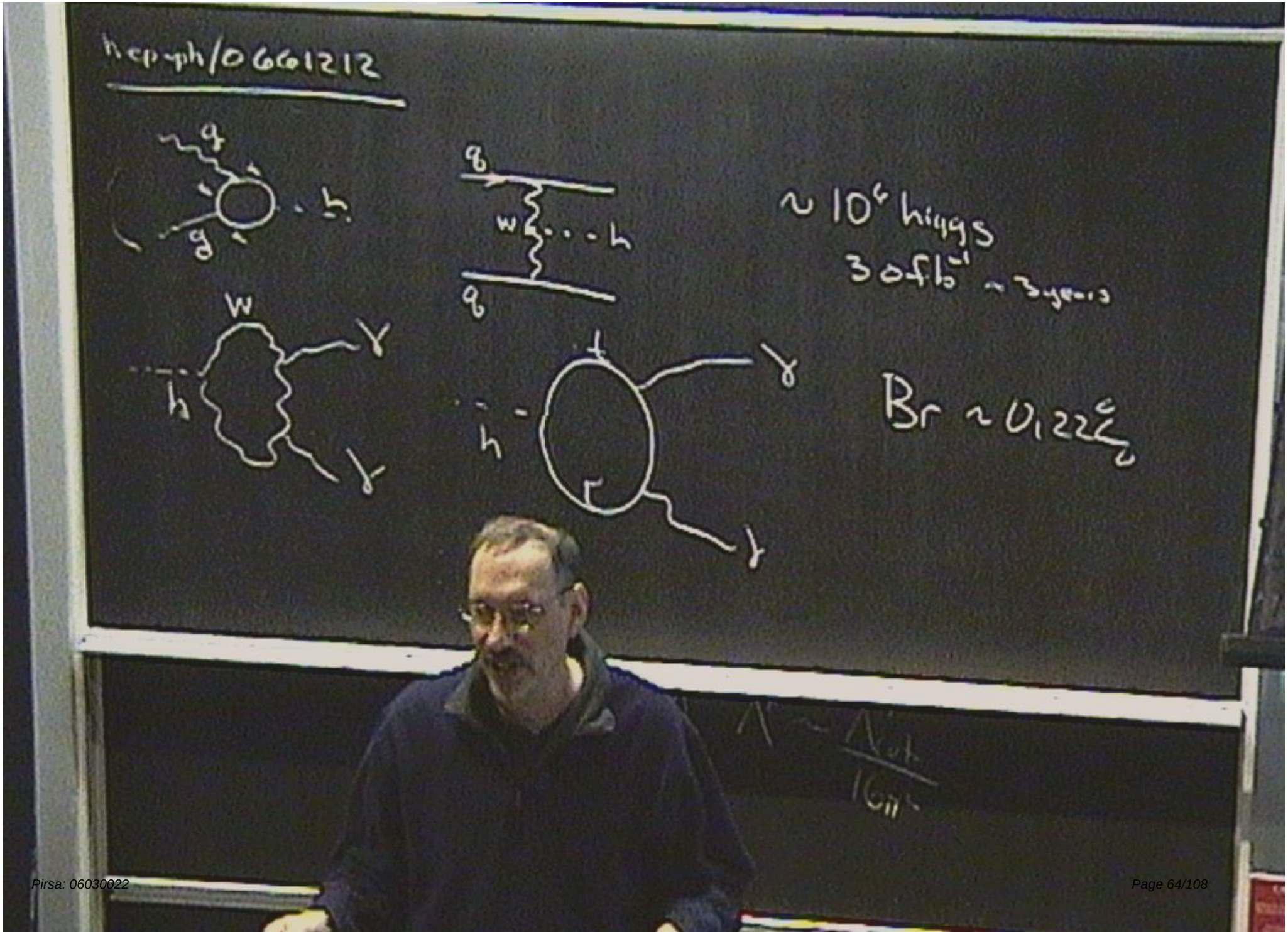

N.P.
g
g
mass
Scale Λ
$C_a \sim \frac{g_i^2 N}{16\pi^2}$
$g_i N_1$

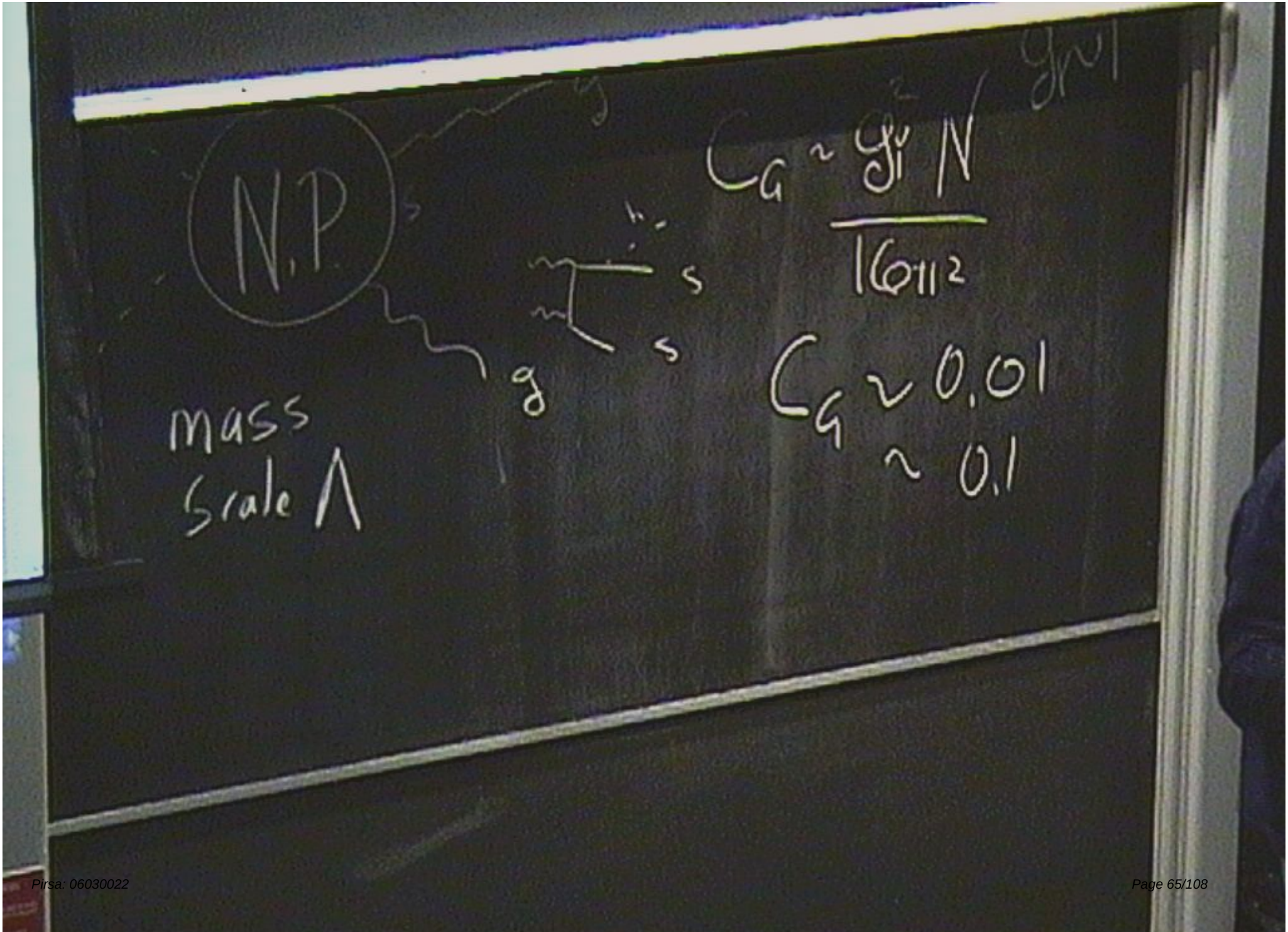

N.P
g
g
mass
Scale Λ
$C_G \sim \frac{g_i^2 N}{16\pi^2}$
$g_i \sim 1$
$C_G \gtrsim 0.01$
~ 0.1

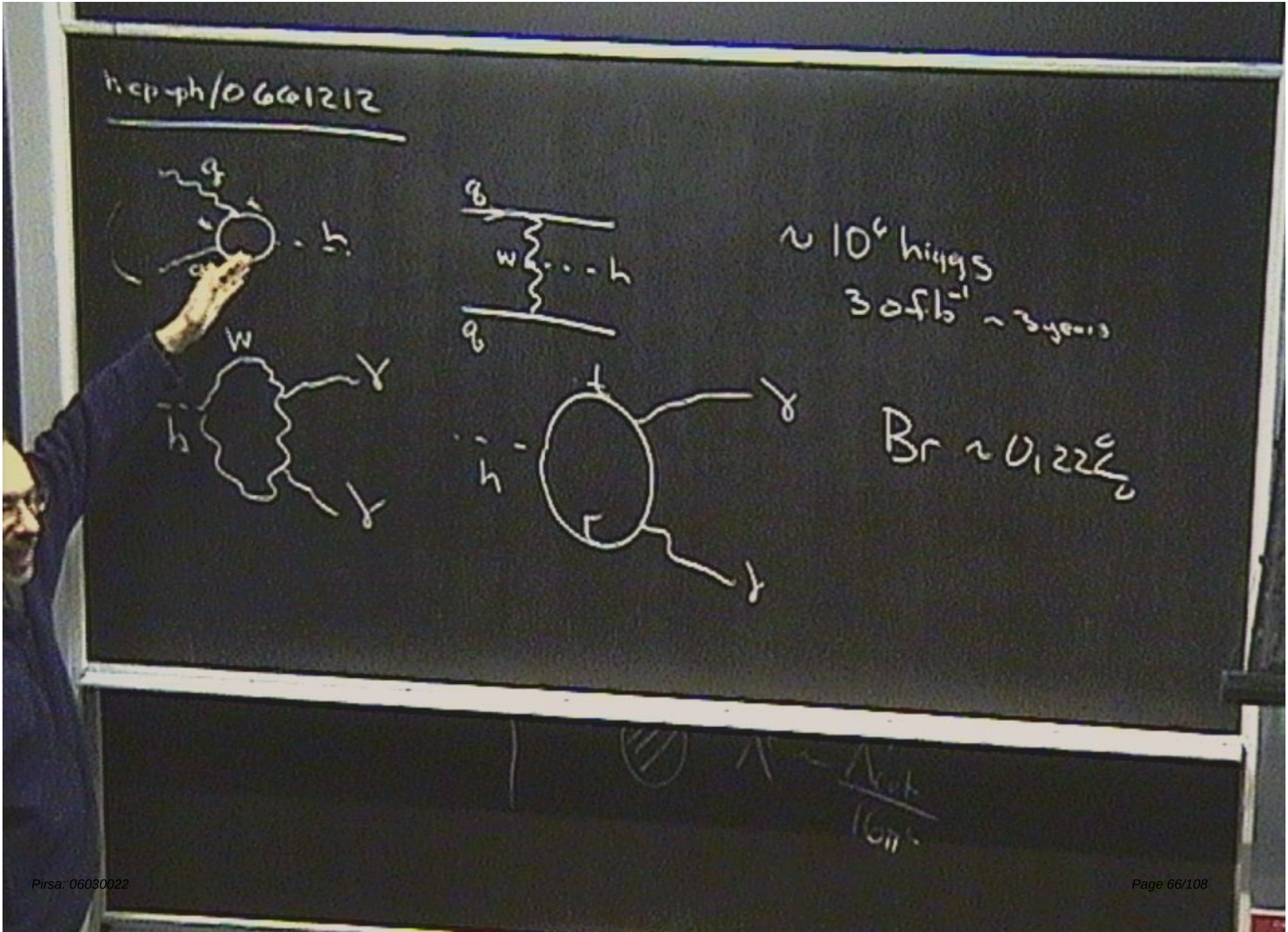

$\delta\mathcal{L} = -\frac{C_G g_s^2}{2\Lambda^2} H^\dagger H G^a_{\mu\nu} G^{a\mu\nu} - \frac{C_W g_2^2}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$
$- \frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - C_W$
$H^\dagger H G^a_{\mu\nu}$
$\rightarrow \frac{v^2}{2} G^a_{\mu\nu}$
$H = \begin{pmatrix} 0 \\ \frac{v+h}{\sqrt{2}} \end{pmatrix}$
$\Lambda \sim 1\,\text{TeV}$

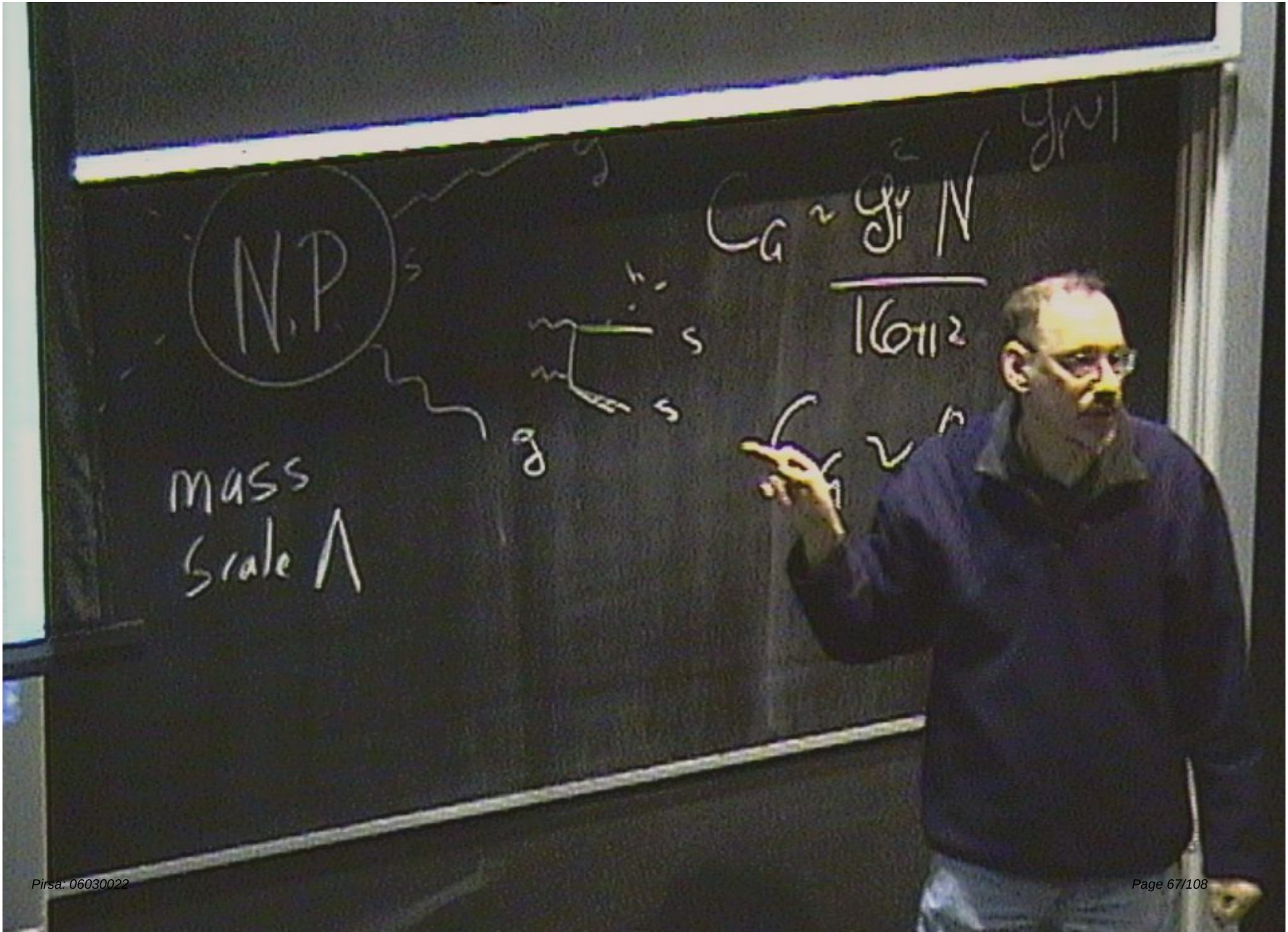

N.P
mass
Scale Λ
g
$L_G \sim \frac{y_i N}{16\pi^2}$
$G \sim 0.01$
~ 0.1

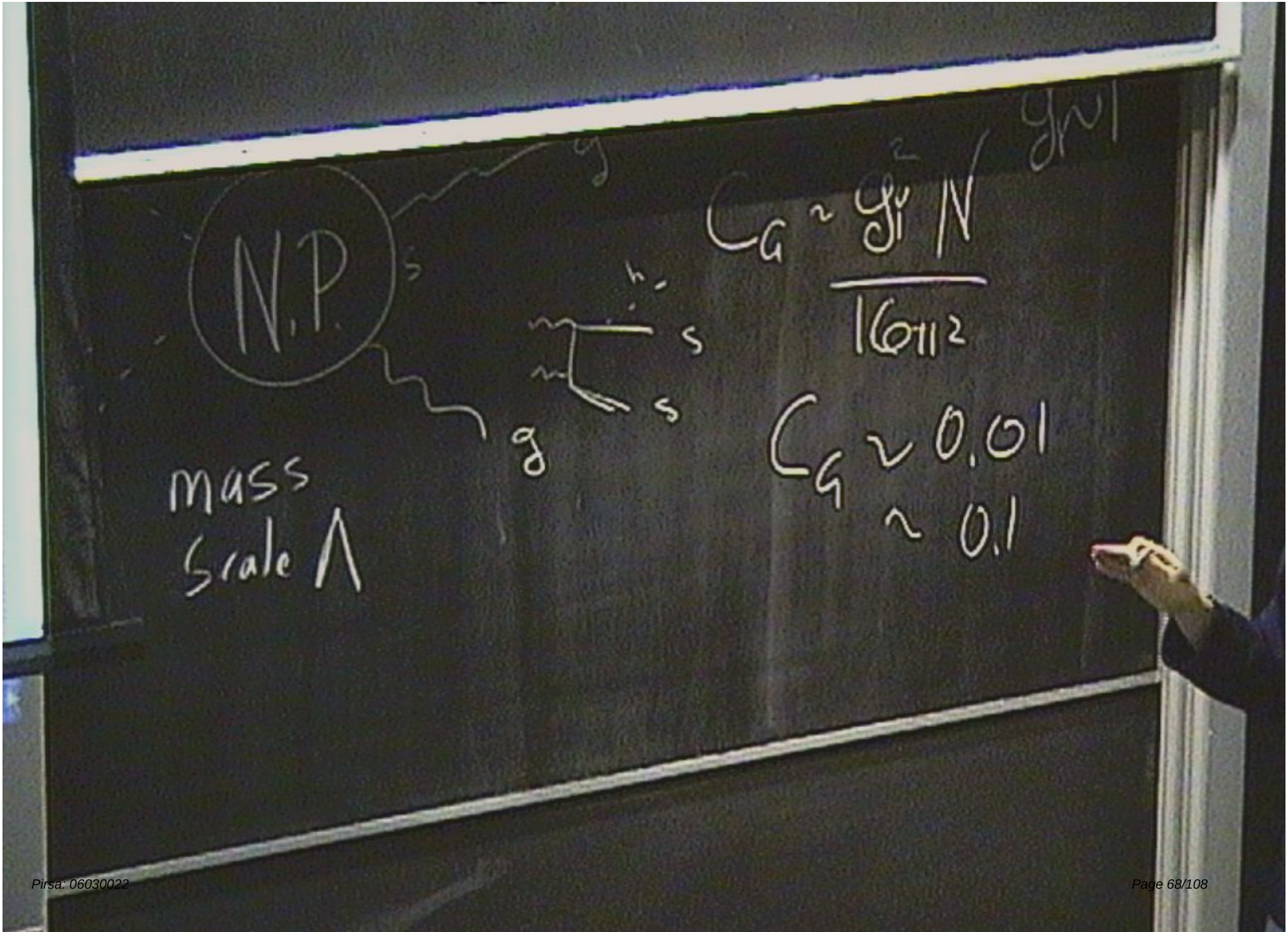

N.P.
mass
Scale Λ
g
s
s
$C_G \sim \frac{y_i N}{16\pi^2}$
$C_G \sim 1$

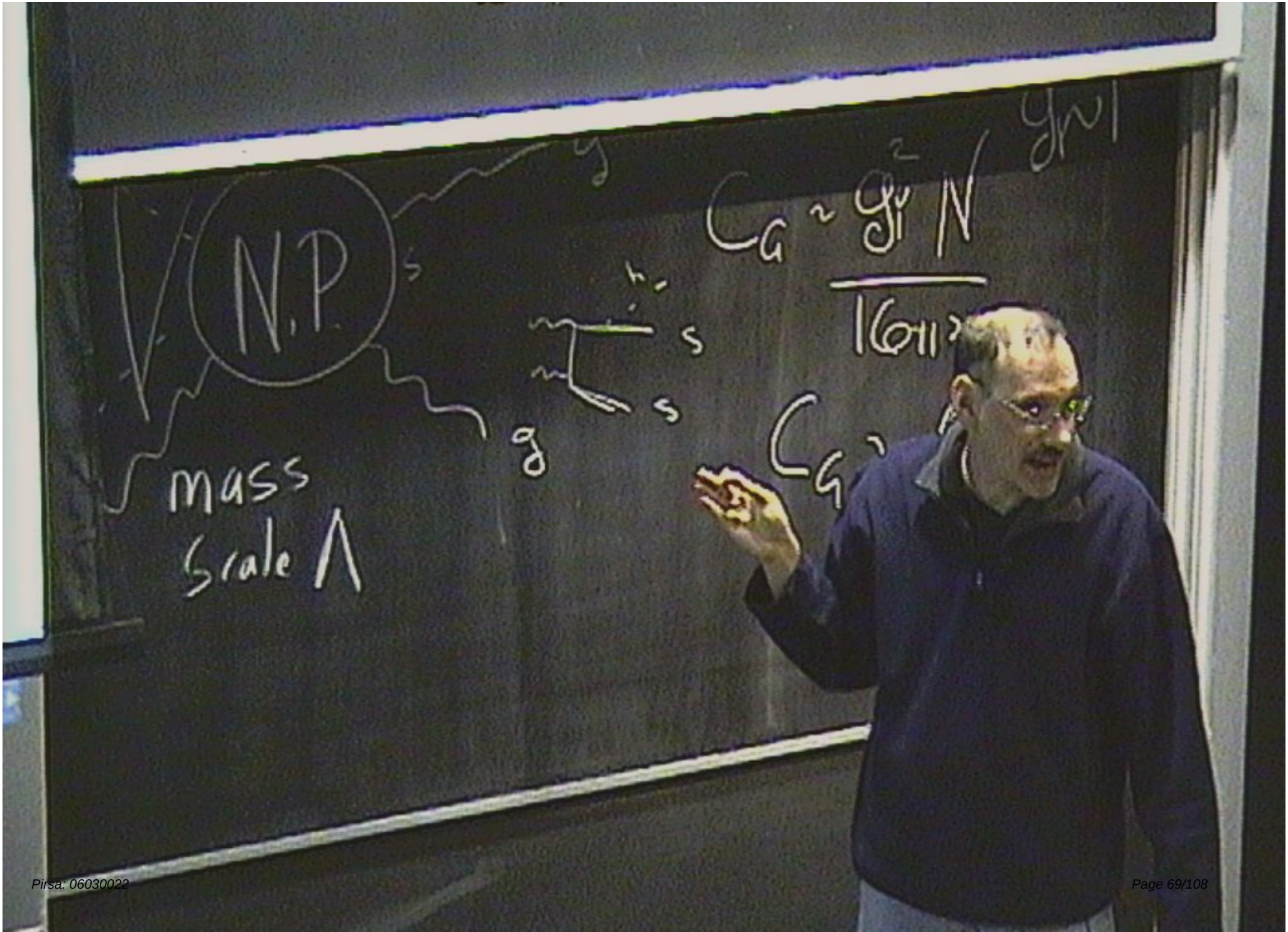

hep-ph/0601212
q
q
h
g
g
W
h
q
W
h
q
$\sim 10^6$ higgs
$30 fb^{-1}$ ~ 3 years
W
γ
h
γ
t
γ
h
t
γ
Br ~ 0,22%

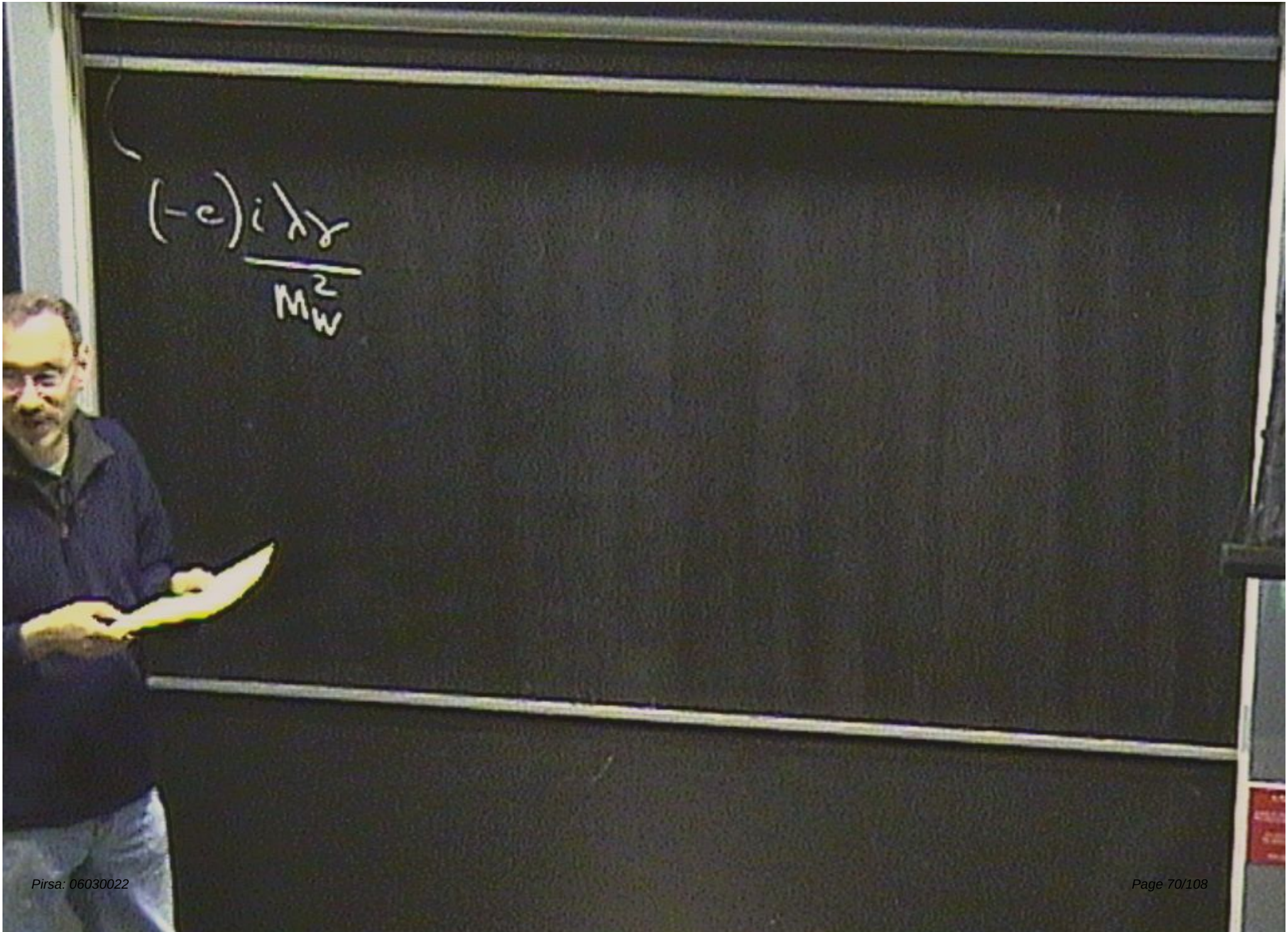

N.P
mass
Scale Λ
g
s
s
$C_q \sim \frac{g_i N}{16\pi^2}$
$C_q \sim 0.01$
~ 0.1

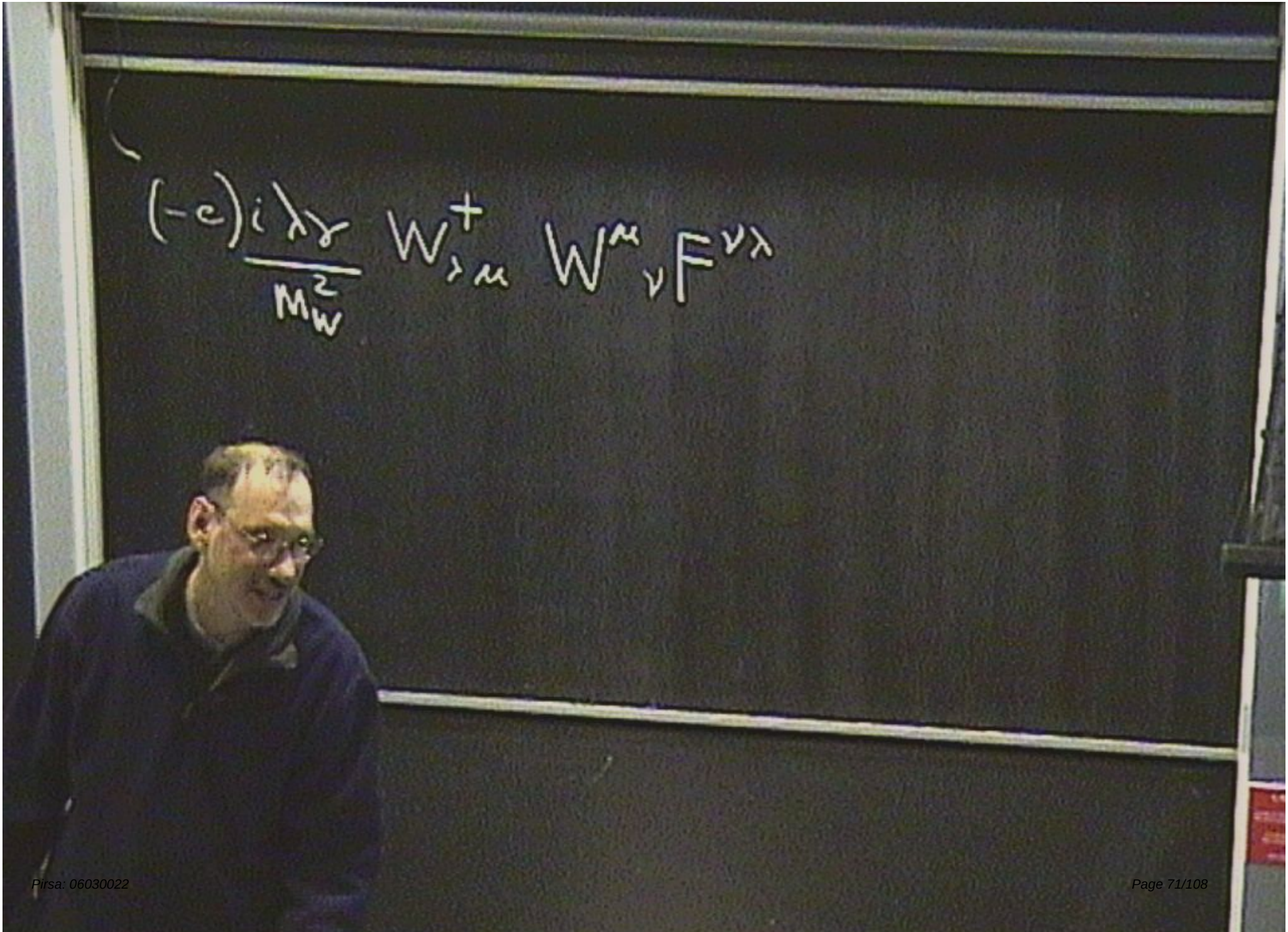

hep-ph/0601212
q
h
W
γ
γ
q
W
h
q
$\sim 10^6$ higgs
$30\,fb^{-1}$ ~ 3 years
t
γ
h
t
γ
Br ~ 0.122%

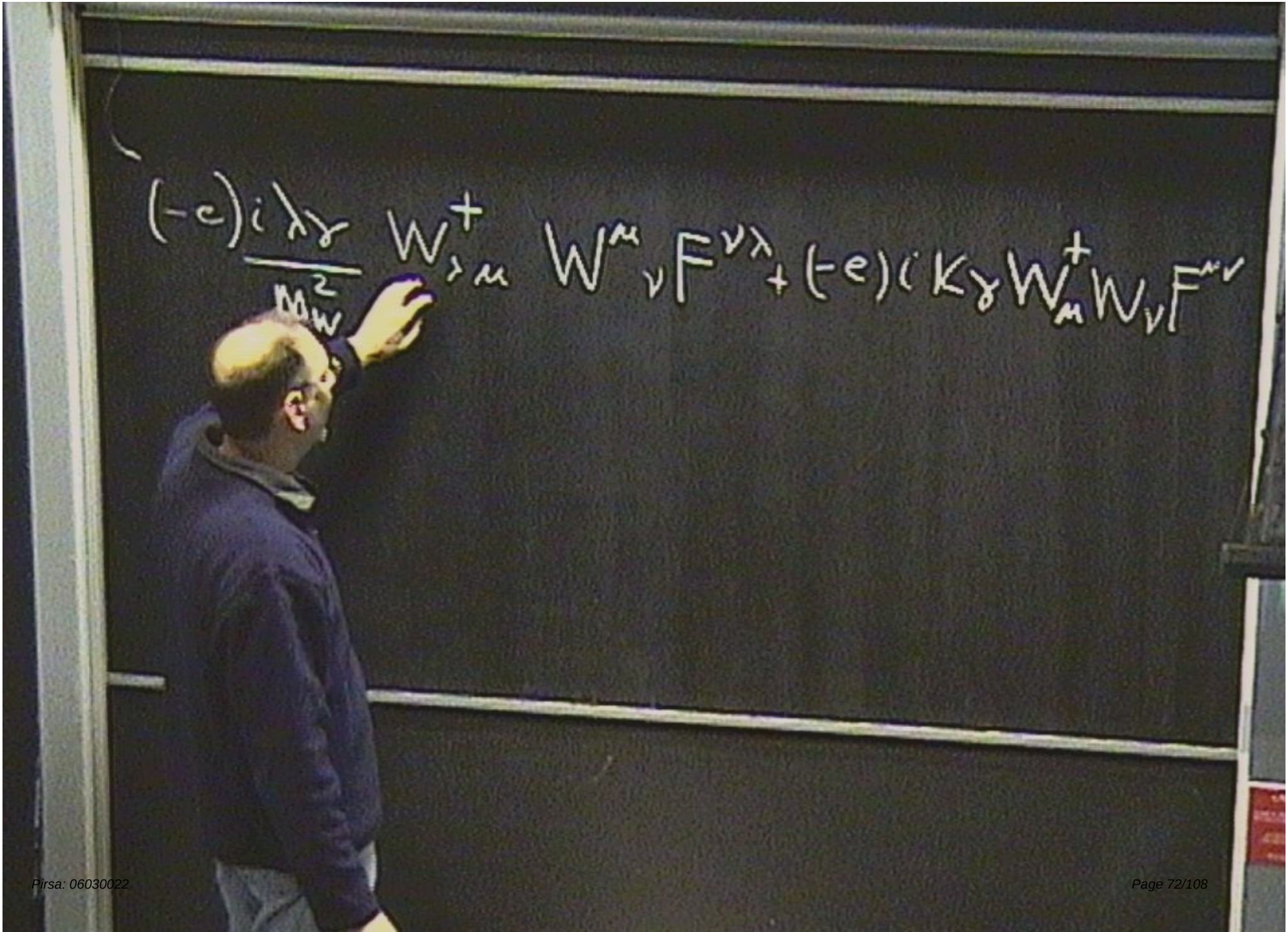

N.P
mass
Scale Λ
g
s
s
$L_G \sim \frac{g_i^2 N}{16\pi^2}$
g_{NN}

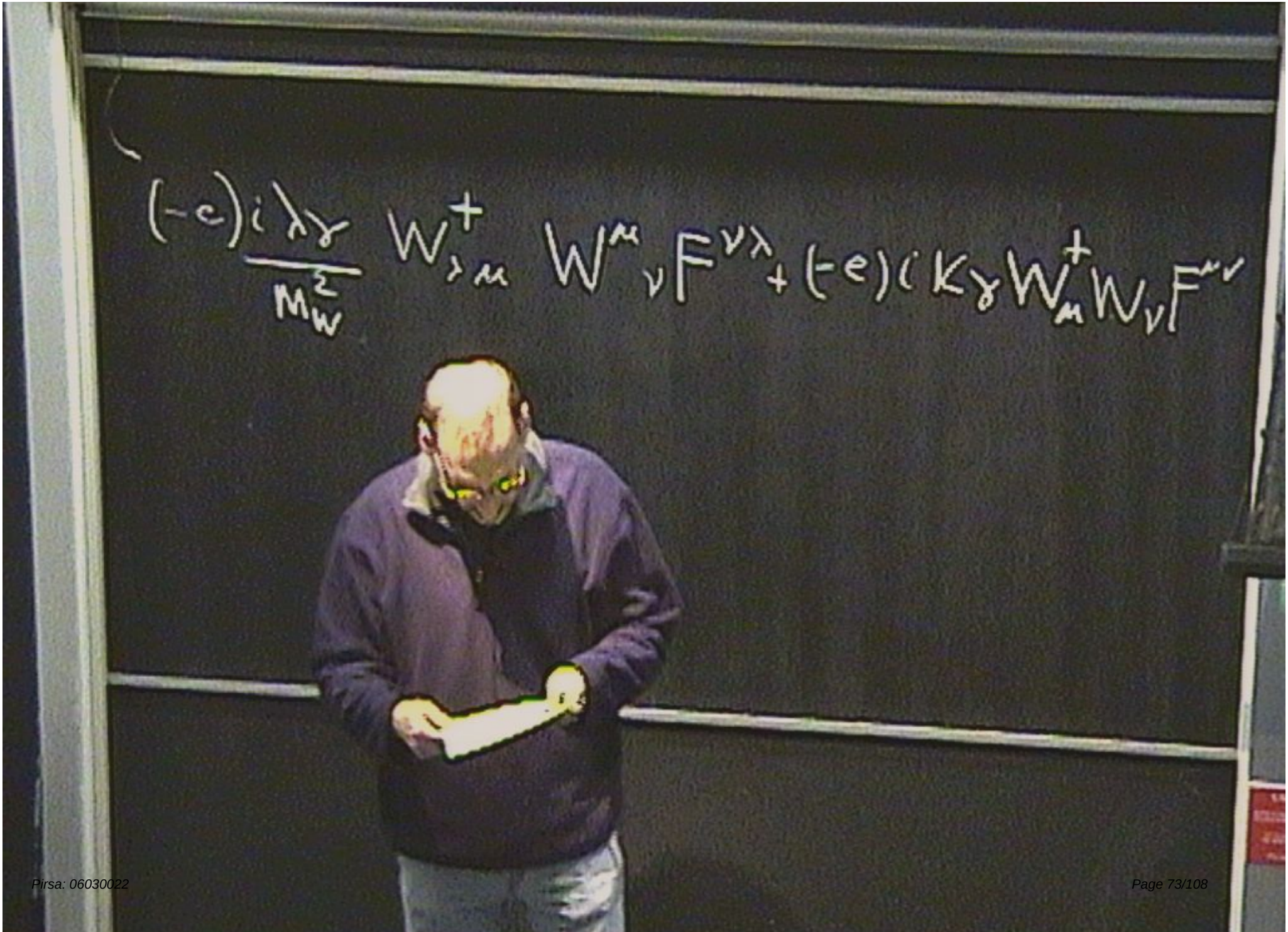

N.P.
g
s
s
g
$C_G \sim \frac{g_i^2 N}{16\pi^2}$
g_{SM}
$C_G \sim 0.01$
~ 0.1
mass
Scale Λ


N.P.
mass
Scale Λ
g
s
s
$C_G \sim \frac{g_i^2 N}{16\pi^2}$
g_{NI}


$(-e)\frac{i\lambda_\gamma}{M_W^2}$

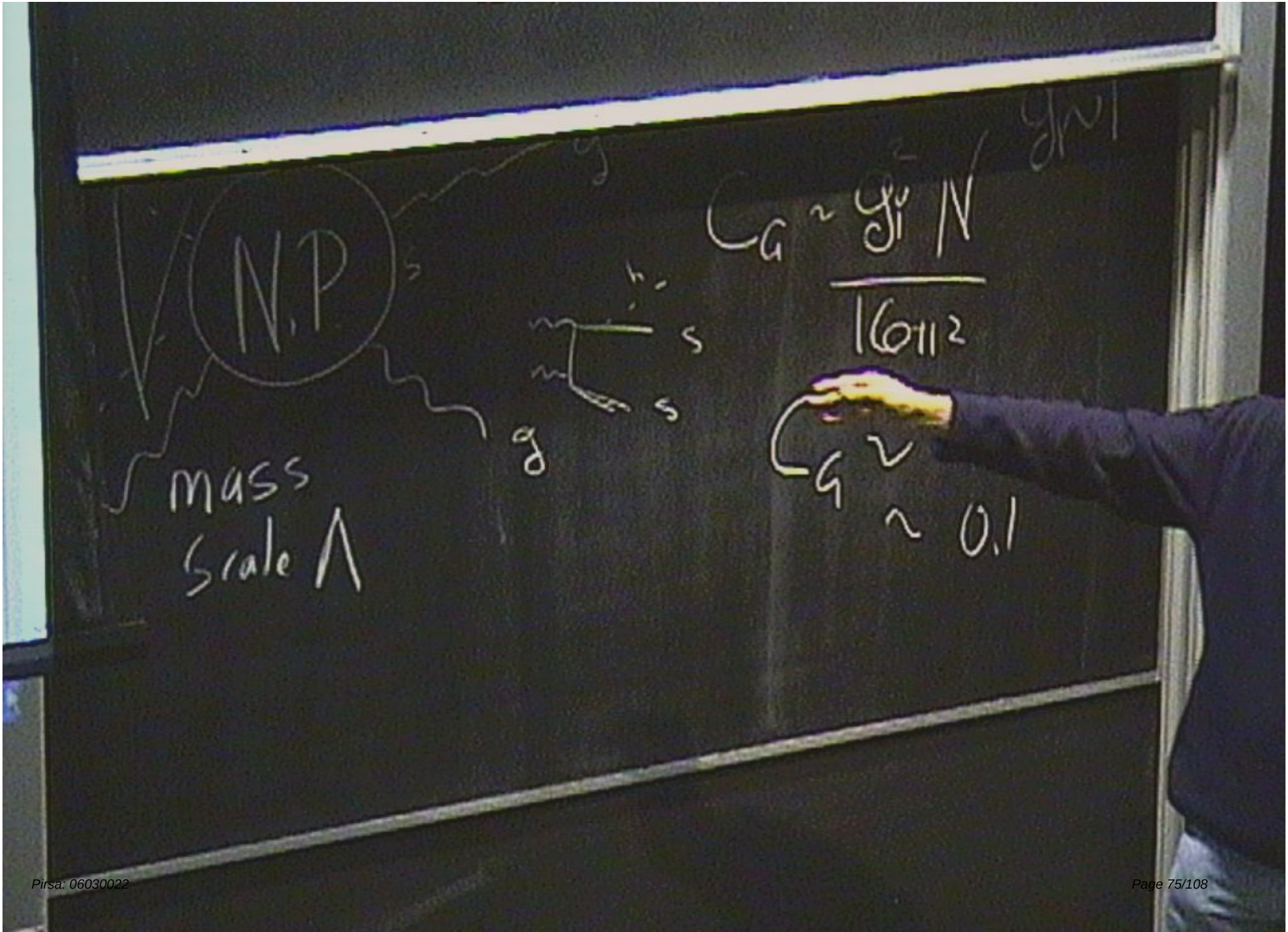

$(-e)\frac{i\lambda\gamma}{M_W^2} W^+_{\lambda\mu} W^{\mu}{}_{\nu} F^{\nu\lambda}$

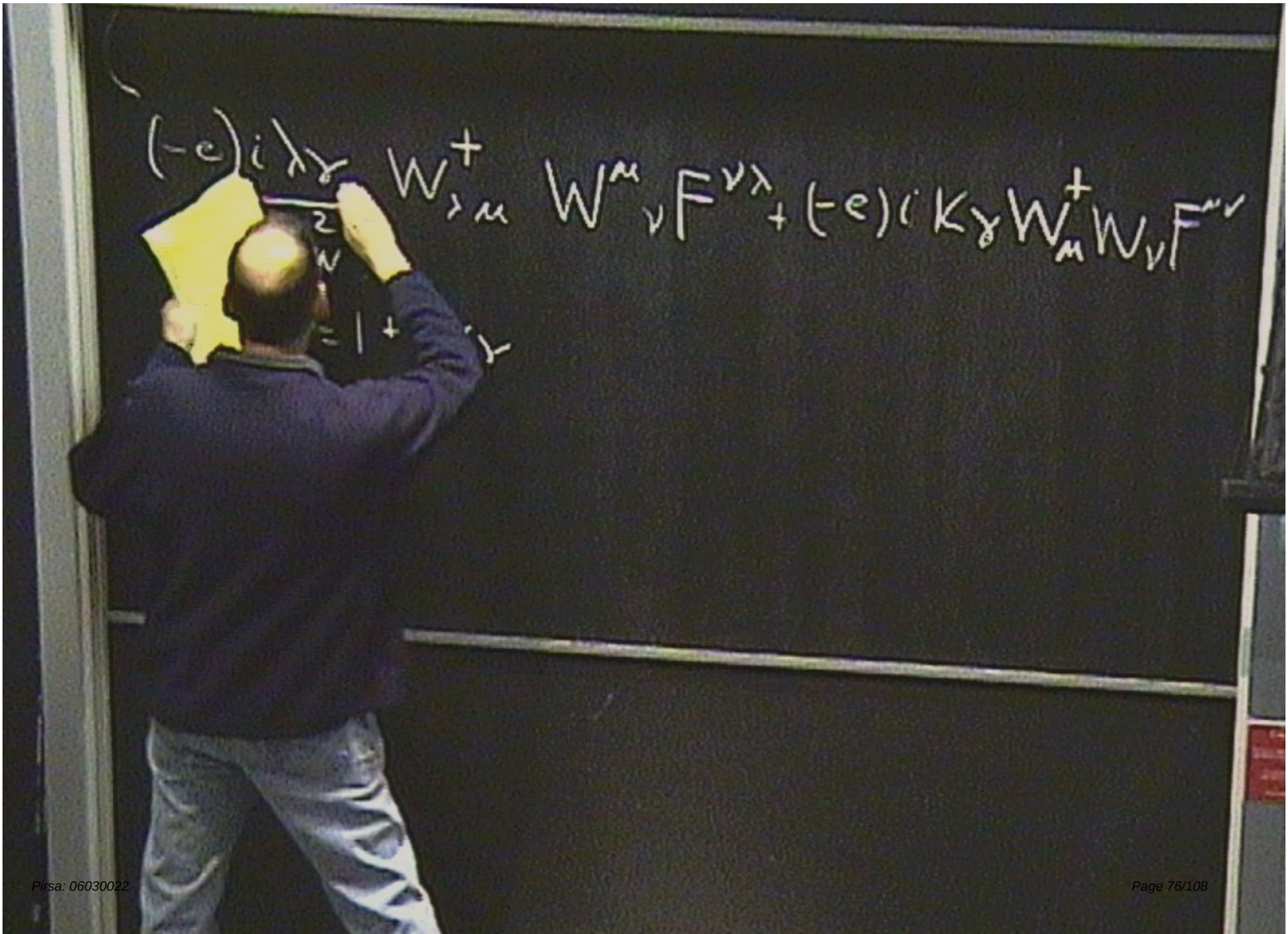

$(-e)i\lambda\gamma \frac{}{M_W^2} W^+_{\lambda\mu} W^{\mu}{}_{\nu} F^{\nu\lambda} + (-e)(i\kappa\gamma W^+_{\mu} W_{\nu} F^{\mu\nu}$

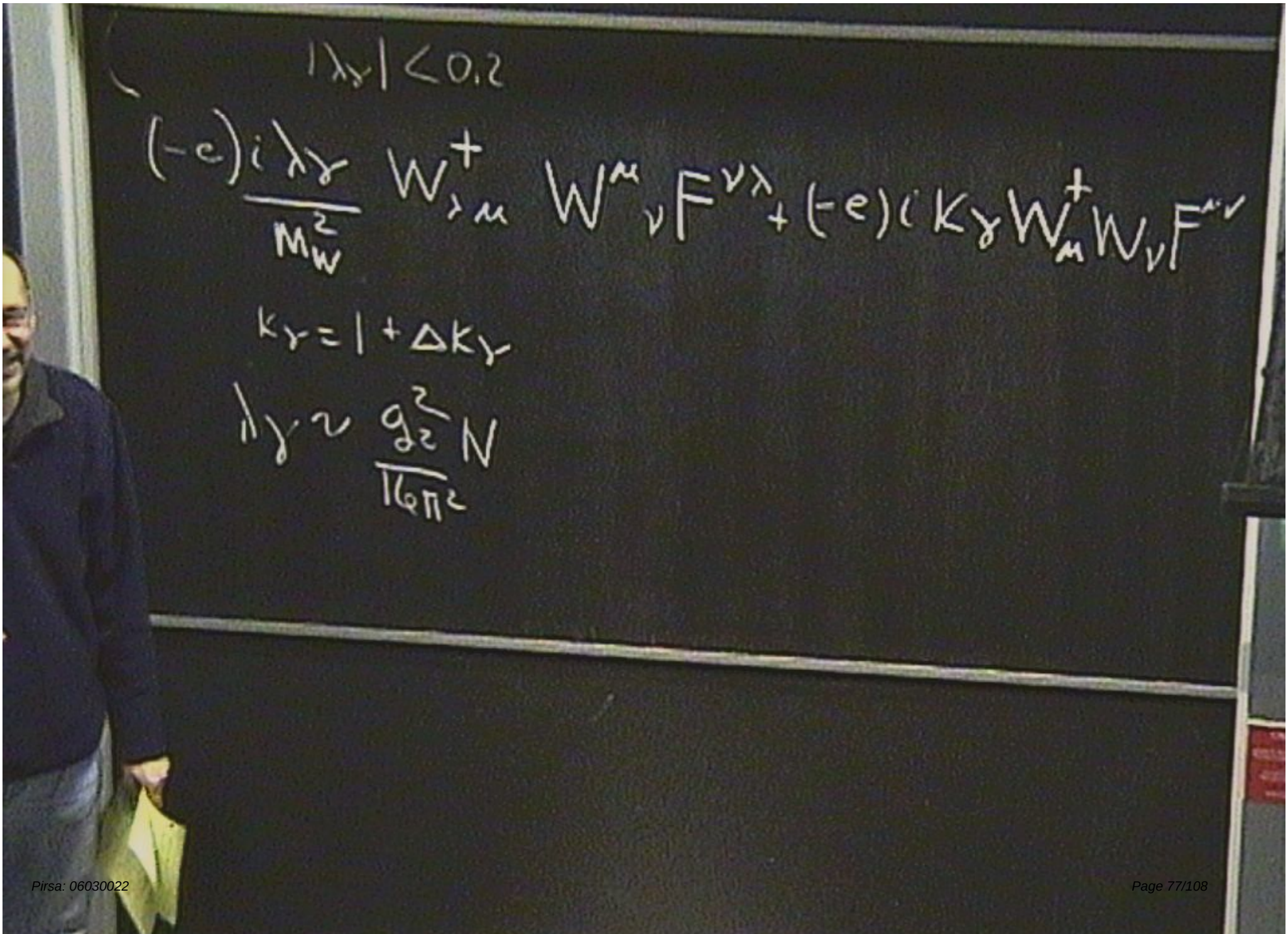

$(-e)(\lambda\gamma \frac{}{M_W^2} W^+_{\lambda\mu} W^{\mu}{}_{\nu} F^{\nu\lambda} + (-e)(K\gamma W^+_{\mu} W_{\nu} F^{\mu\nu}$

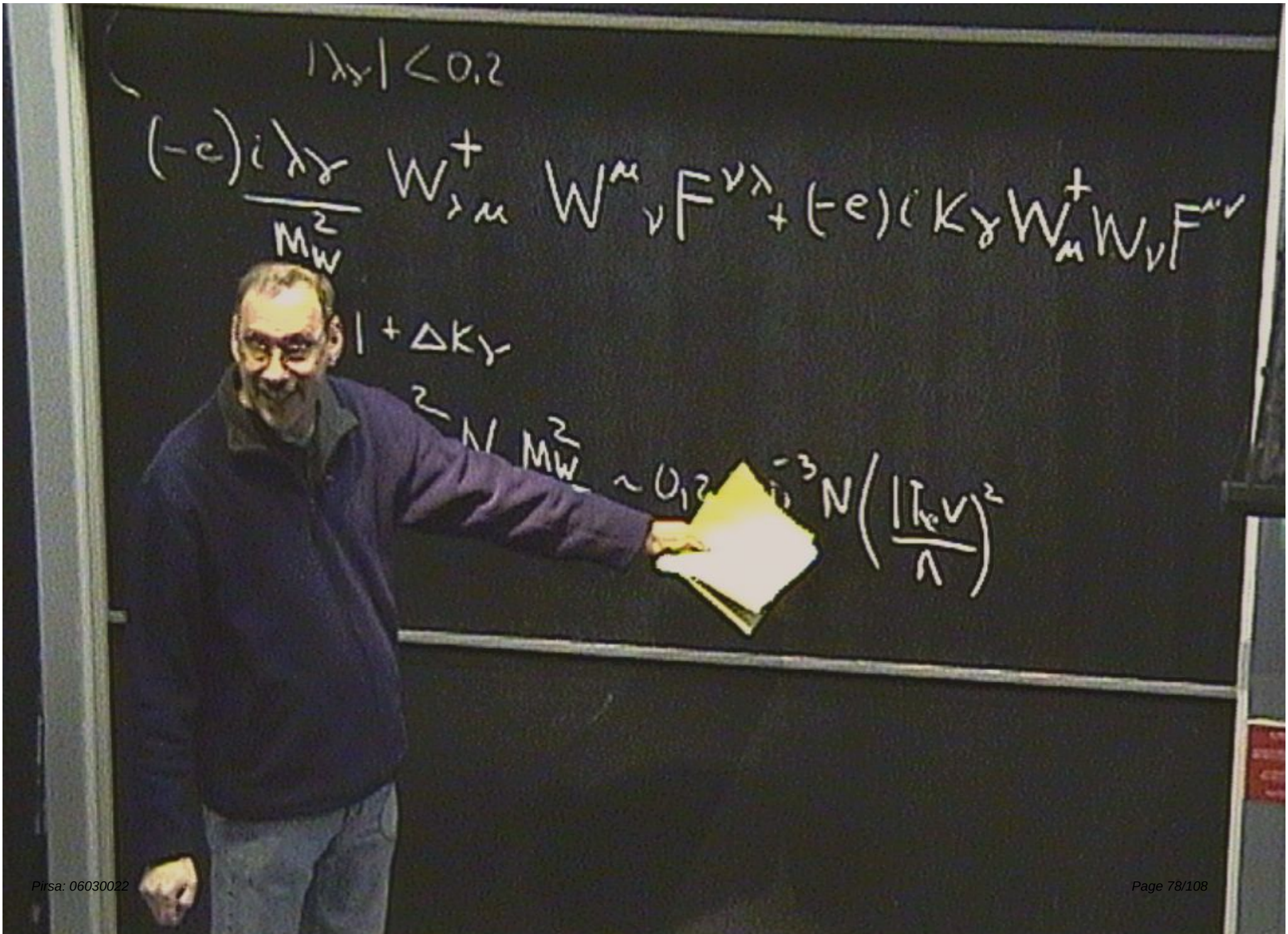
$$(-e)\frac{i\lambda_\gamma}{M_W^2} W^+_{\lambda\mu} W^\mu{}_\nu F^{\nu\lambda} + (-e)(i\kappa_\gamma W^+_\mu W_\nu F^{\mu\nu}$$

$$\kappa_\gamma = 1 + \Delta\kappa_\gamma$$


N.P
mass
Scale Λ
g
s
s
$\lambda_G \sim \frac{y_i N}{16\pi^2}$
$\lambda_G^2 \sim 0.1$


(-e)
W
W F
F


$|\lambda_\gamma| < 0.2$
$(-e)\frac{i\lambda_\gamma}{M_W^2} W^+_{\lambda\mu} W^{\mu}{}_{\nu} F^{\nu\lambda} + (-e)(i\kappa_\gamma W^+_\mu W_\nu F^{\mu\nu}$
$\kappa_\gamma = 1 + \Delta\kappa_\gamma$
$\Delta\kappa_\gamma \sim \frac{g_2^2 N}{16\pi^2}$

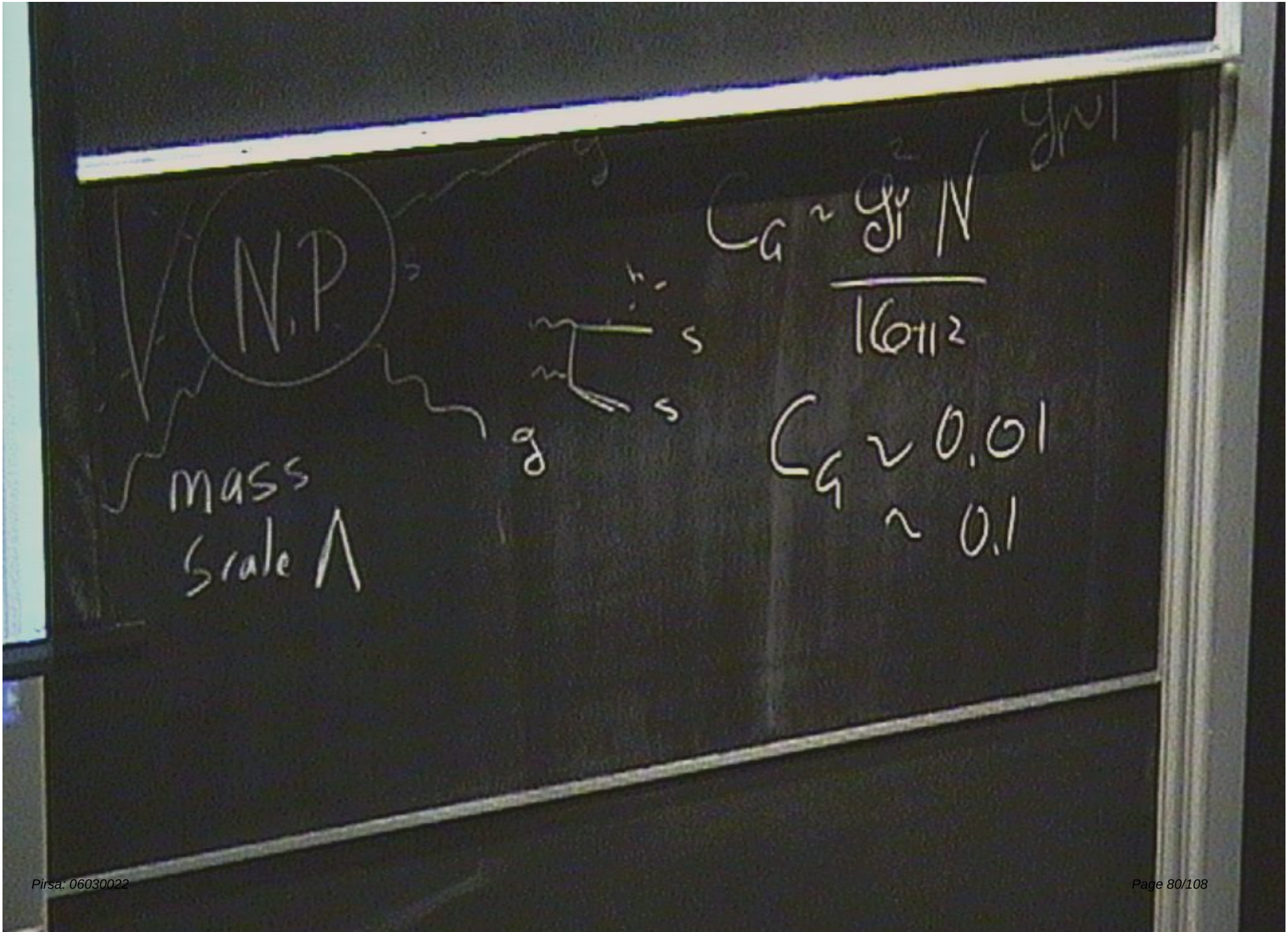

$|\lambda_\gamma| < 0.2$
$(-e)\frac{i\lambda_\gamma}{M_W^2} W^+_{\gamma\mu} W^{\mu\nu} F^{\nu\lambda} + (-e)(1+\Delta\kappa_\gamma) W^+_\mu W_\nu F^{\mu\nu}$
~ 0.2
$N\left(\frac{|T_{ev}|^2}{\Lambda}\right)$

$|\lambda_\gamma| < 0.2$

$$(-e)\frac{i\lambda_\gamma}{M_W^2} W^+_{\lambda\mu} W^{\mu}{}_{\nu} F^{\nu\lambda} + (-e)(i\kappa_\gamma W^+_\mu W_\nu F^{\mu\nu}$$

$$\kappa_\gamma = 1 + \Delta\kappa_\gamma$$

$$\Delta\kappa_\gamma \sim \frac{g^2}{16\pi^2} N \frac{M_W^2}{\Lambda^2} \sim 0.2 \times 10^{-3} N \left(\frac{1\,\mathrm{TeV}}{\Lambda}\right)^2$$

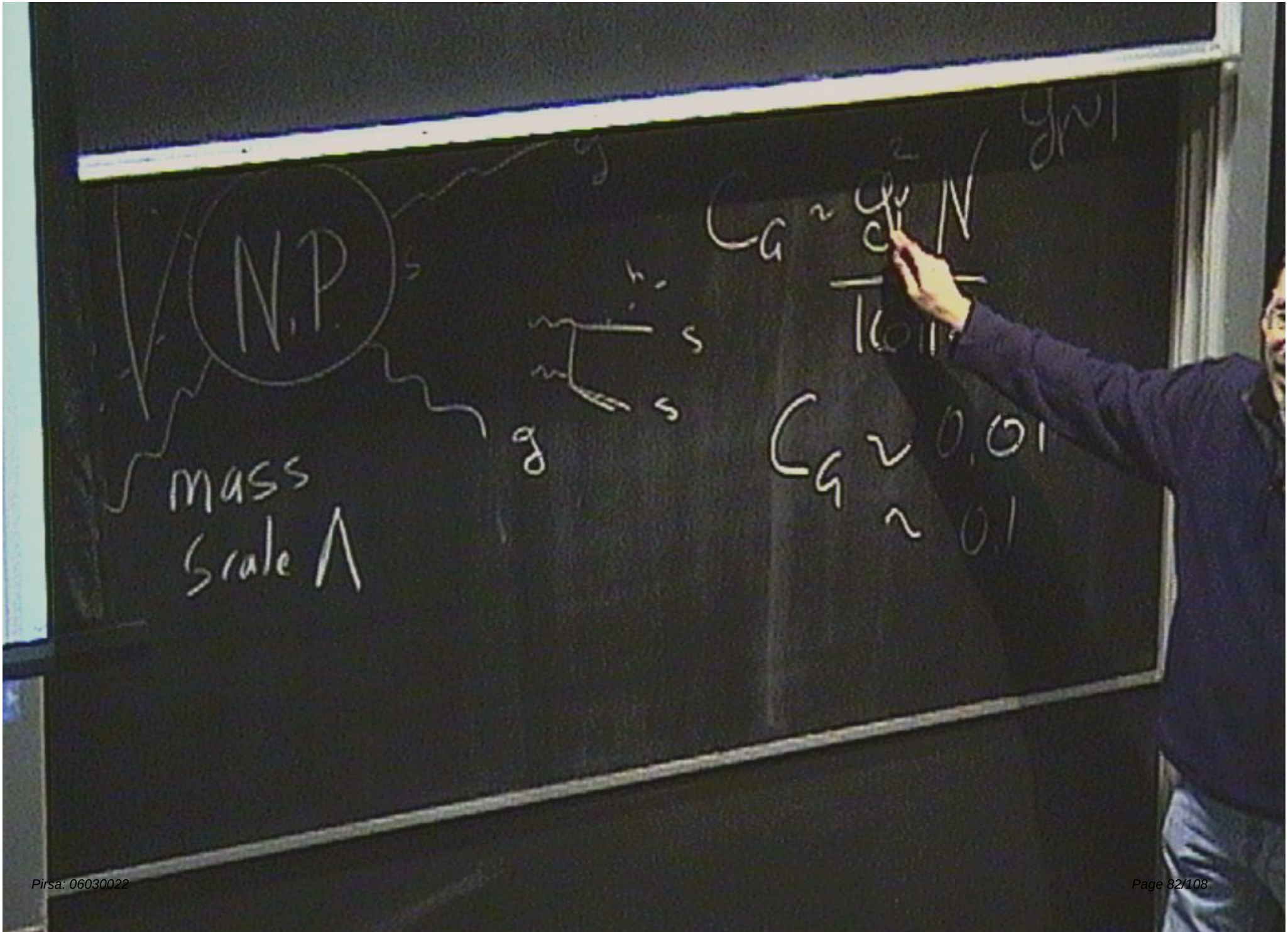

N.P
mass
Scale Λ
g
s
s
$C_q \sim \frac{y_i^2 N}{16\pi^2}$
$y_i \sim 1$
$C_q \sim 0.01$
~ 0.1

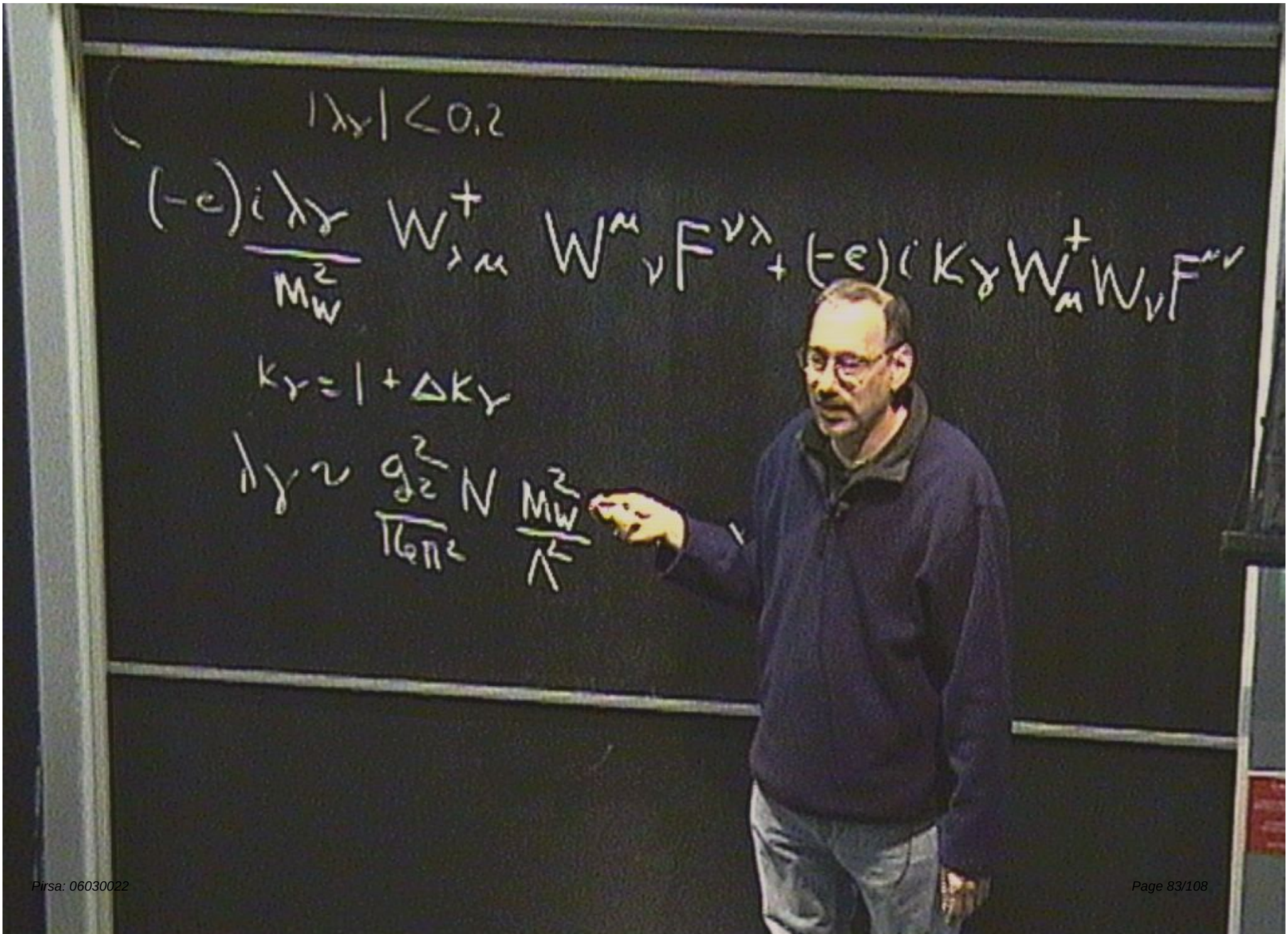
$|\lambda_\gamma| < 0.2$

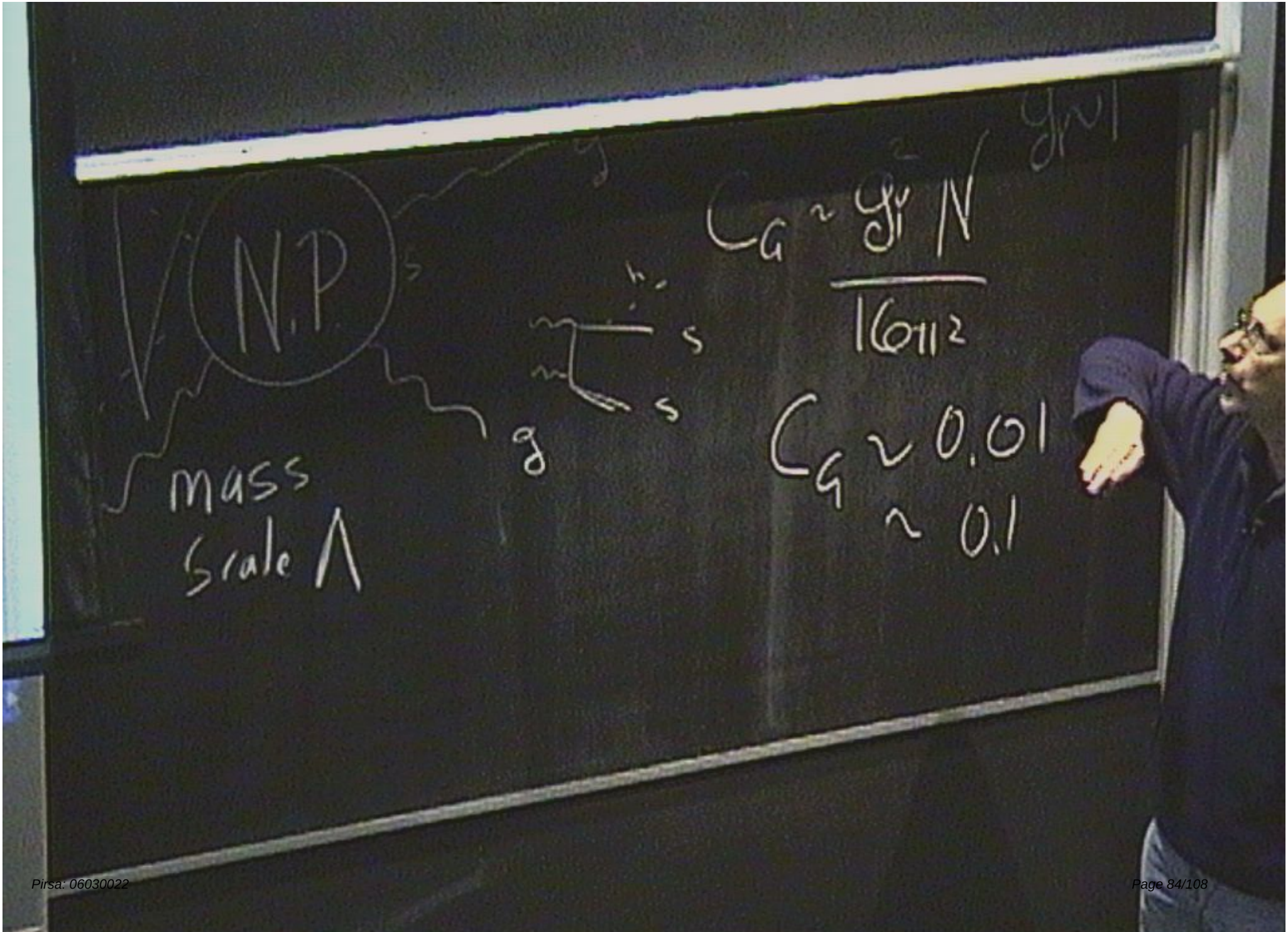
$$(-e)\frac{i\lambda_\gamma}{M_W^2} W^+_{\lambda\mu} W^{\mu}{}_{\nu} F^{\nu\lambda} + (-e)(\kappa_\gamma W^+_\mu W_\nu F^{\mu\nu}$$

$\kappa_\gamma = 1 + \Delta\kappa_\gamma$

$$\lambda_\gamma \sim \frac{g_2^2}{16\pi^2} N \frac{M_W^2}{\Lambda^2} \sim 0.2 \times 10^{-3} N \left(\frac{1\,\mathrm{TeV}}{\Lambda}\right)^2$$


N.P.
mass
Scale Λ
g
s
s
$C_G \sim \frac{g_i^2}{16\pi^2}$
$C_G \sim 0.01$
~ 0.1


$|\lambda_\gamma| < 0.2$
$(-e)\frac{i\lambda_\gamma}{M_W^2} W^+_{\lambda\mu} W^\mu{}_\nu F^{\nu\lambda} + (-e)(i\kappa_\gamma W^+_\mu W_\nu F^{\mu\nu}$
$\kappa_\gamma = 1 + \Delta\kappa_\gamma$
$\Delta\kappa_\gamma \sim \frac{g_2^2}{16\pi^2} N \frac{M_W^2}{\Lambda^2}$


N.P
mass
Scale Λ
g
s
s
$C_G \sim \frac{y_i N}{16\pi^2}$
$C_G \sim 0.01$
~ 0.1

$$\mathcal{L} = -\frac{C_G g_s^2}{2\Lambda^2} H^\dagger H G^a_{\mu\nu} G^{a\mu\nu} - \frac{C_W g_2^2}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$$

$$- \frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - \frac{C_{WB} g_1 g_2}{2\Lambda^2} H^\dagger \tau^a H B_{\mu\nu} W^{a\mu\nu}$$

$$H = \begin{pmatrix} 0 \\ \frac{v}{\sqrt{2}} + \frac{h}{\sqrt{2}} \end{pmatrix}$$

$\Lambda \sim 1\,\text{TeV}$

$$H^\dagger H G^a_{\mu\nu} G^{a\mu\nu} \rightarrow \frac{v^2}{2} G^a_{\mu\nu} G^{a\mu\nu} + \frac{v}{\Lambda} h G^a_{\mu\nu}$$

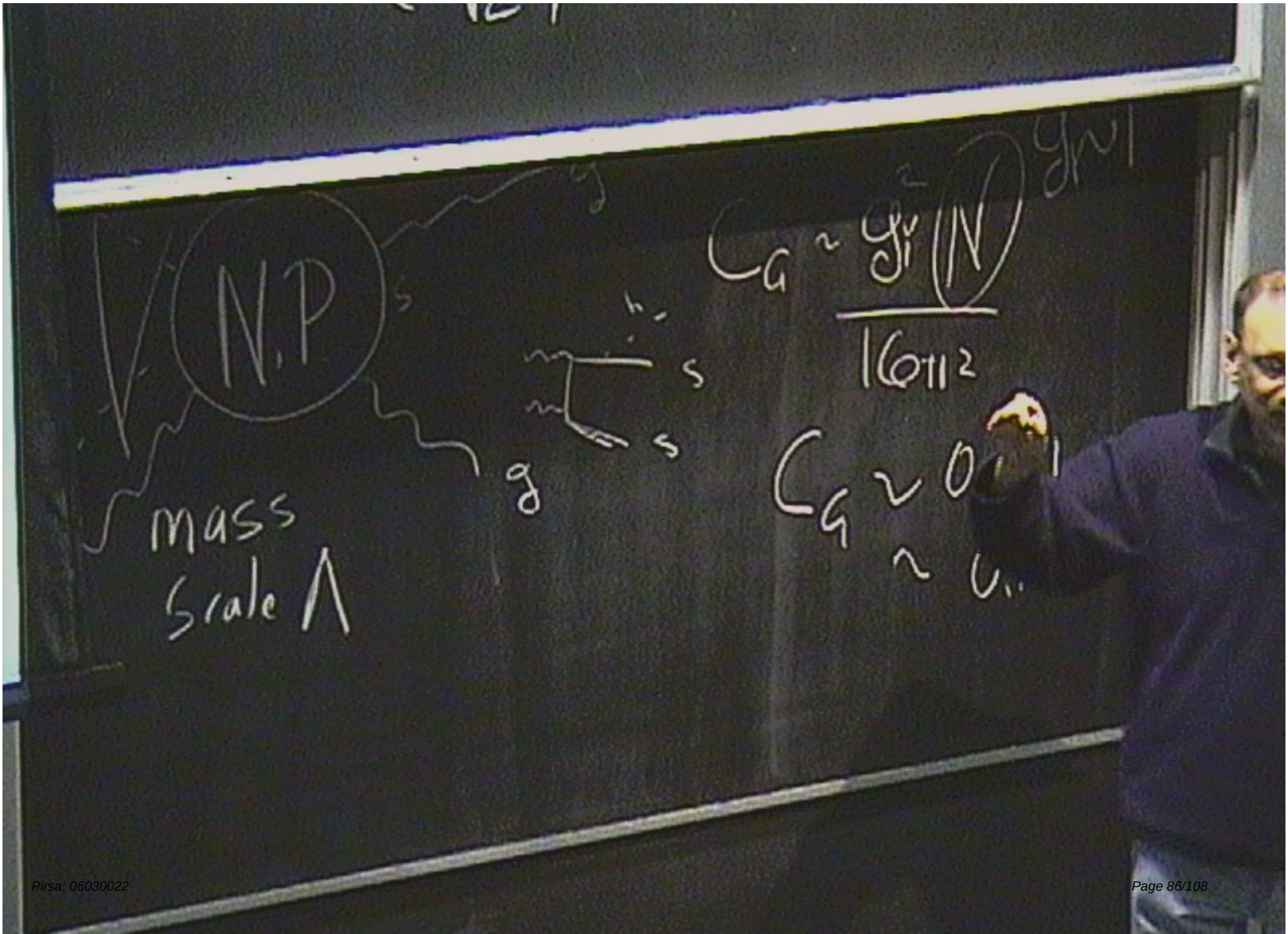
N.P.

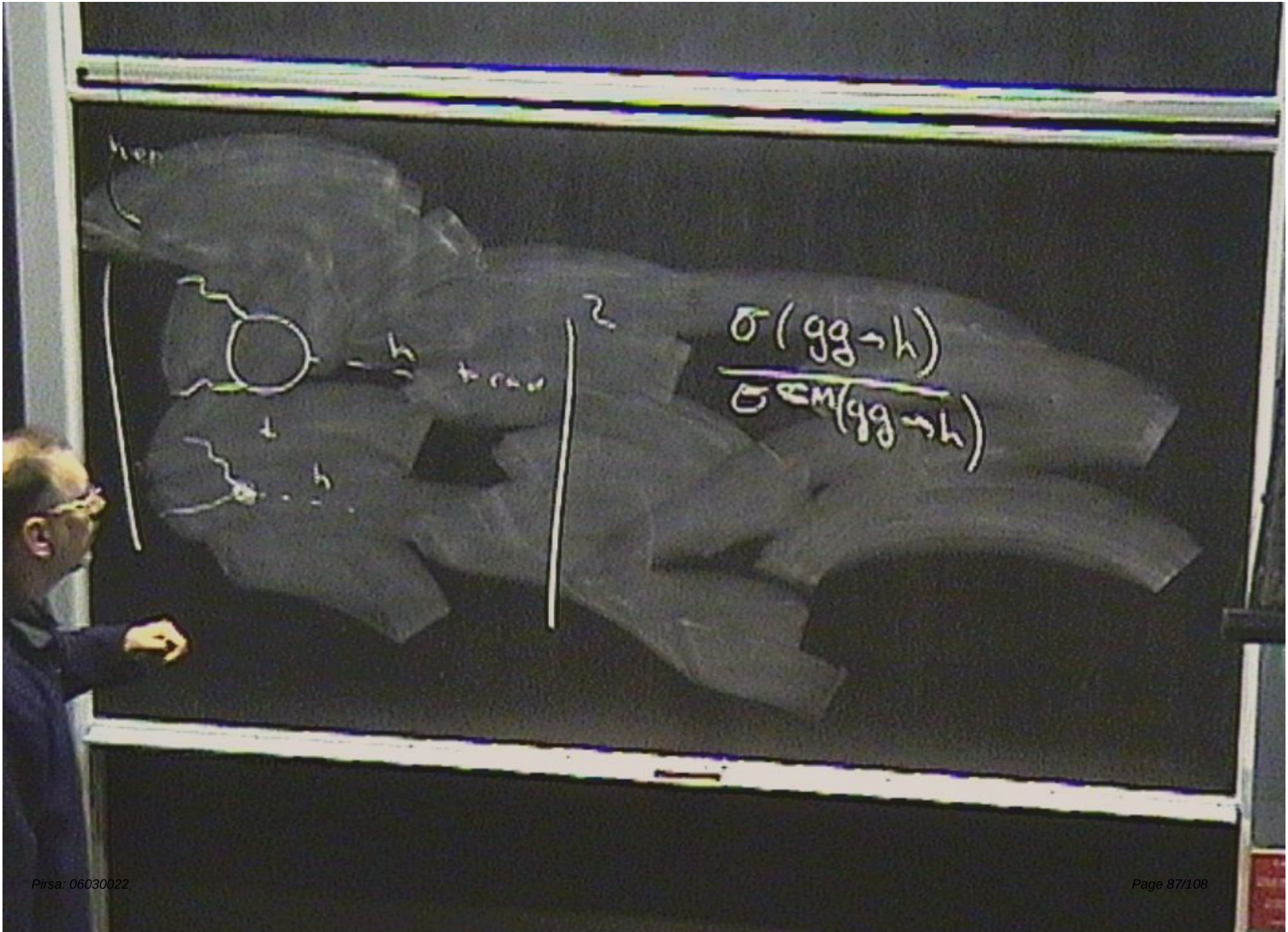
mass scale Λ

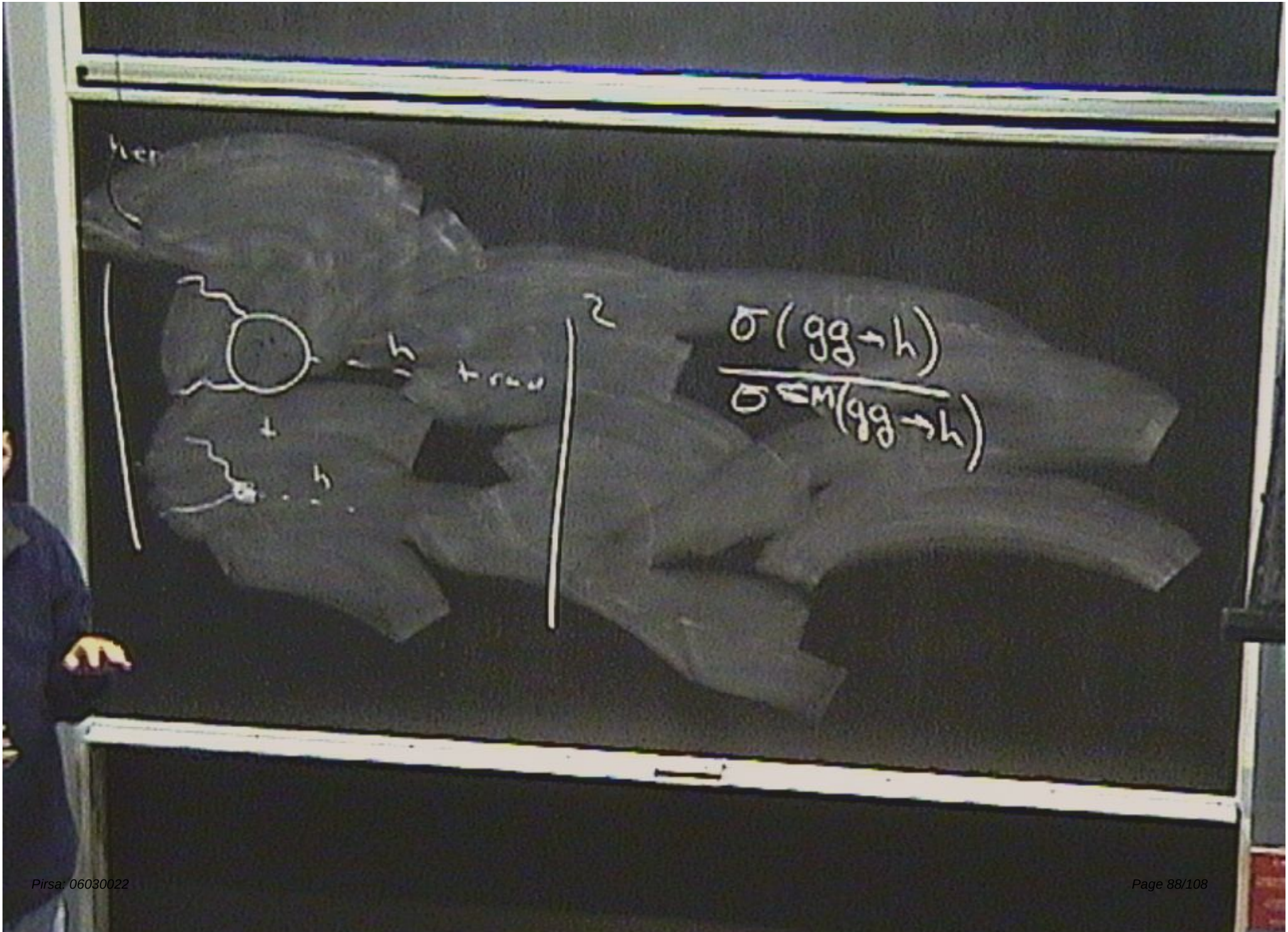
$$C_G \sim \frac{y_t^2 N}{16\pi^2}$$

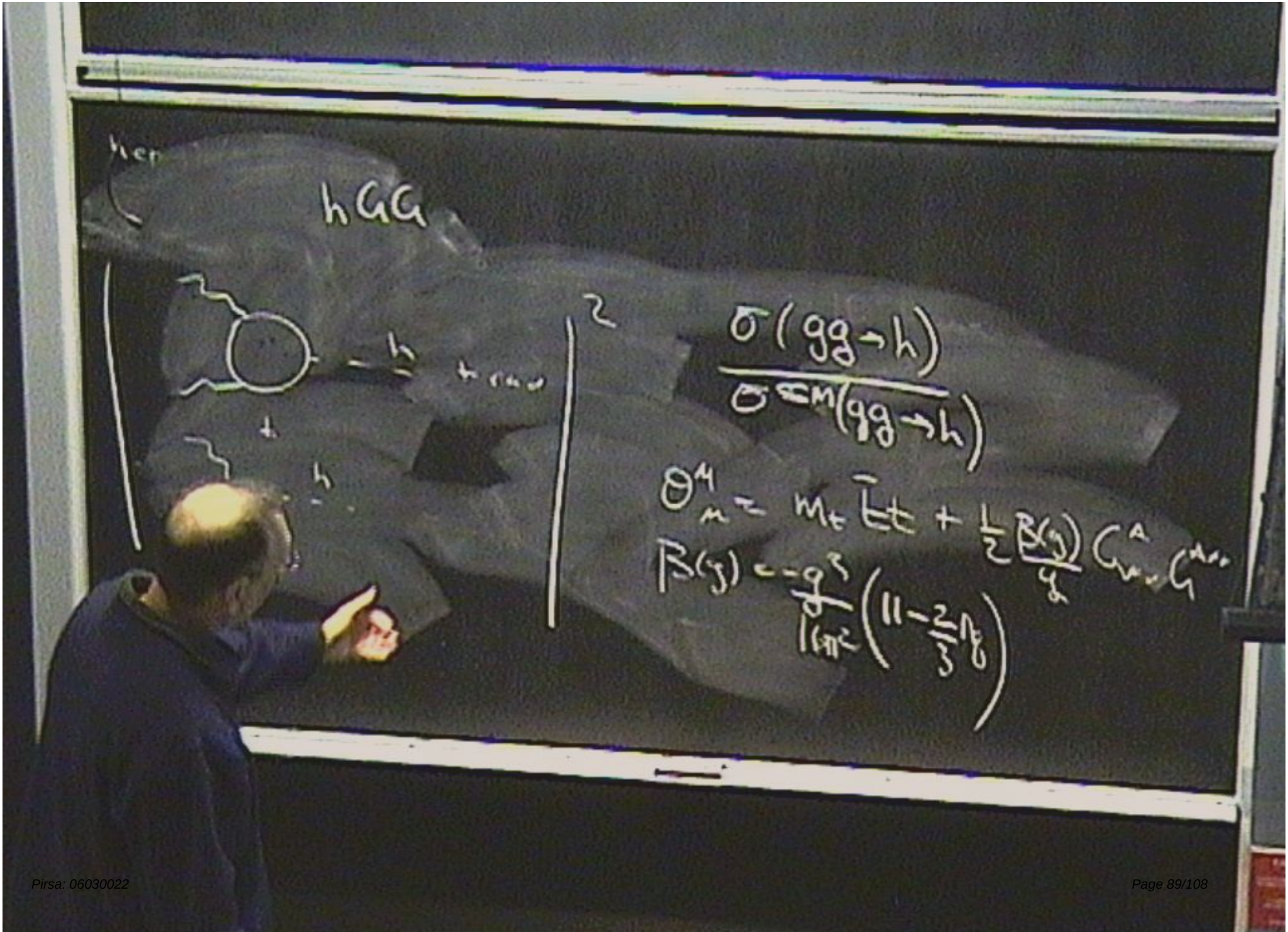
$C_G \sim 0.01$

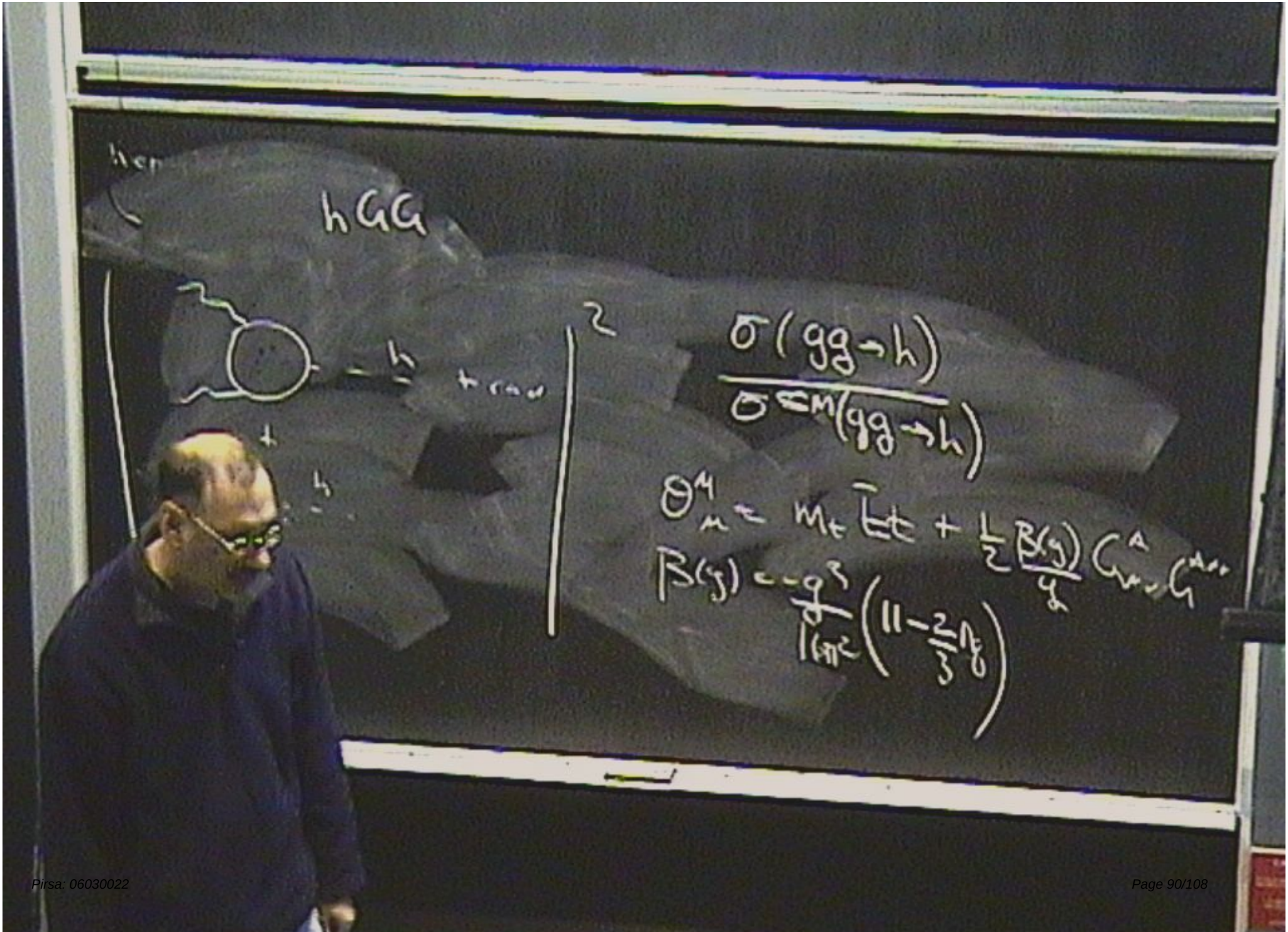
~ 0.1

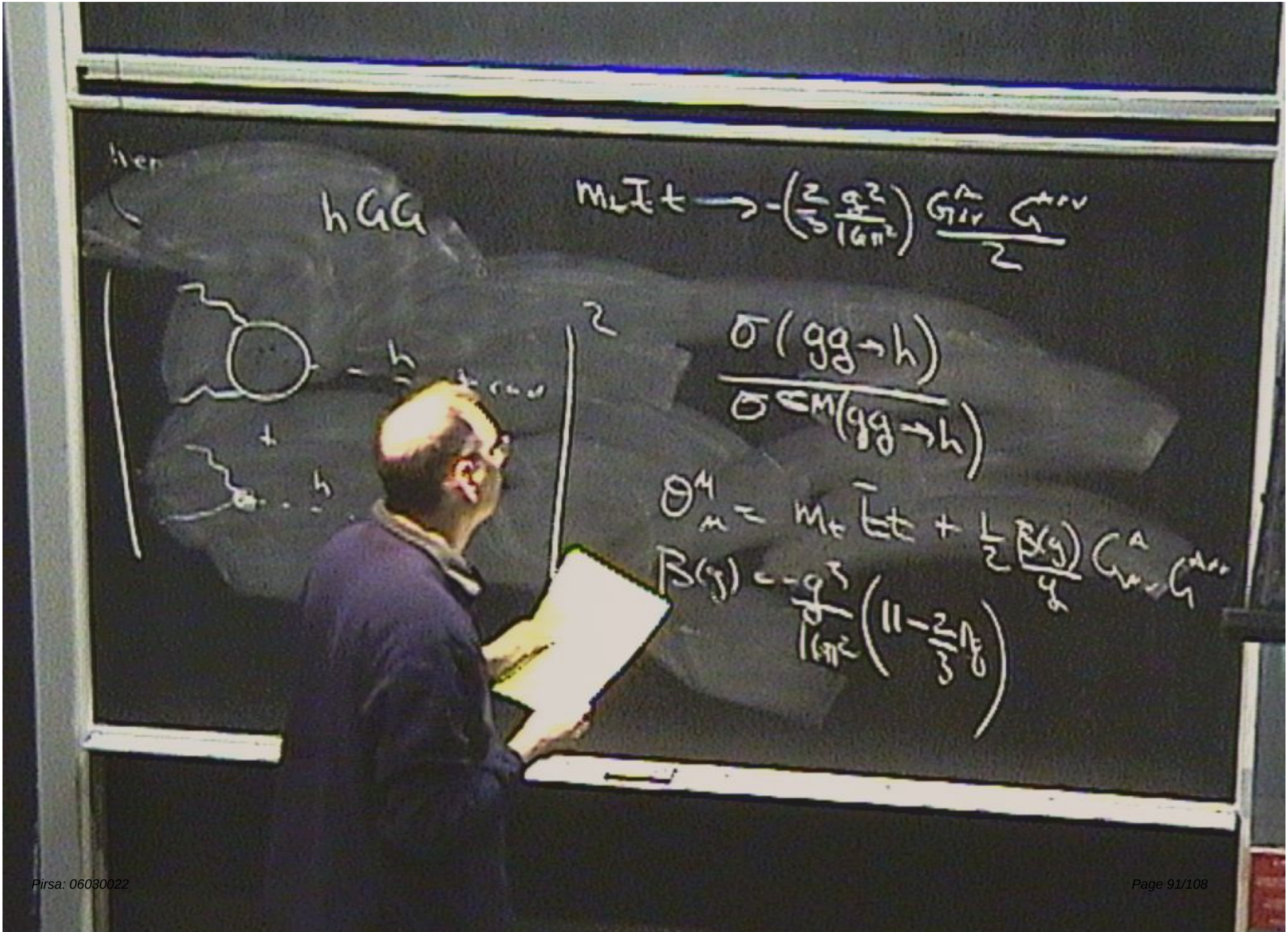

N.P
mass
Scale Λ
g
s
s
$C_q \sim \frac{y_i^2 (N)}{16\pi^2}$
$C_q \sim 0.1$
$\sim 0.$

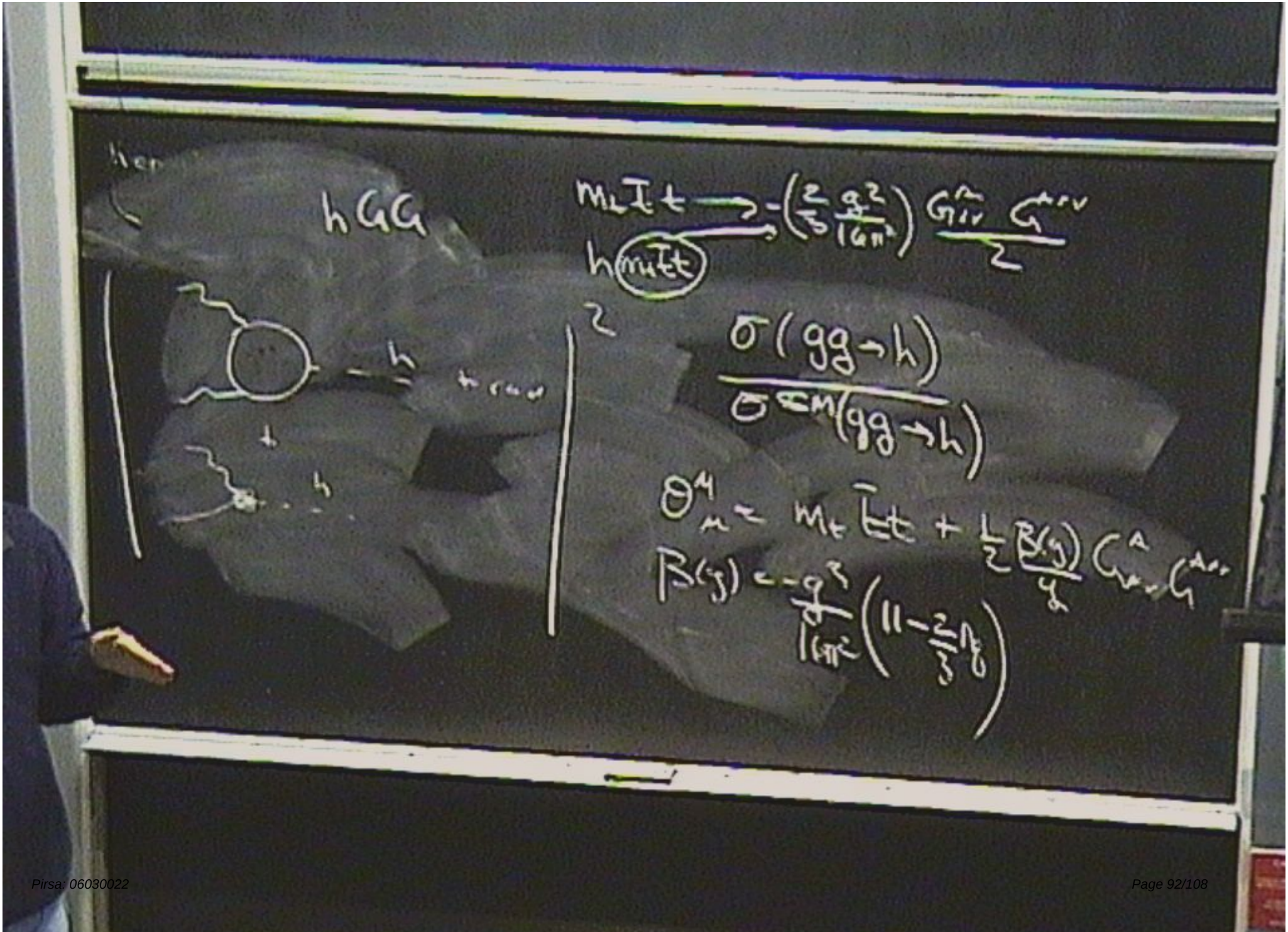

$\frac{\sigma(gg \to h)}{\sigma^{SM}(gg \to h)}$

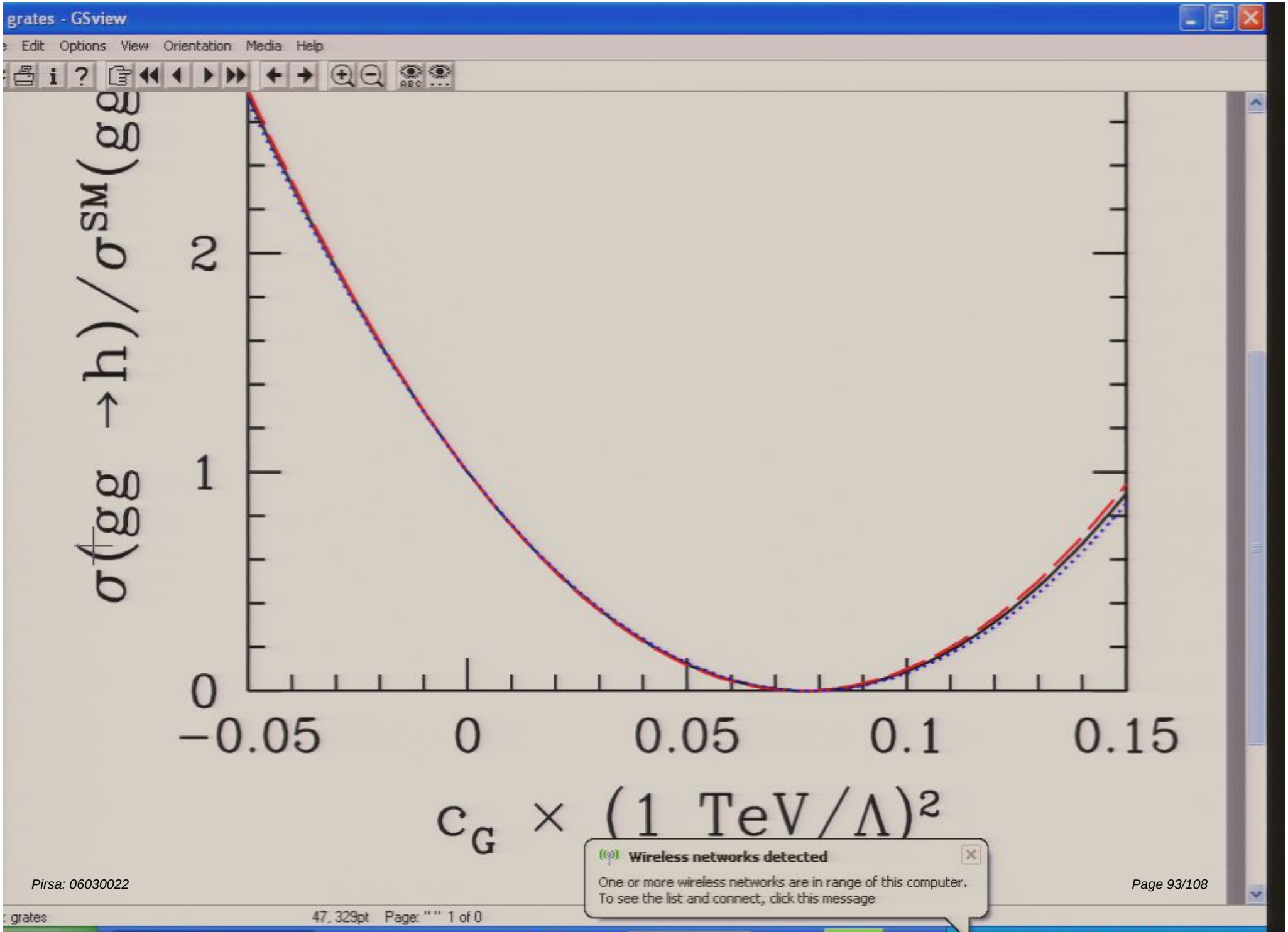

h
t
t
h
$\frac{\sigma(gg \to h)}{\sigma^{SM}(gg \to h)}$

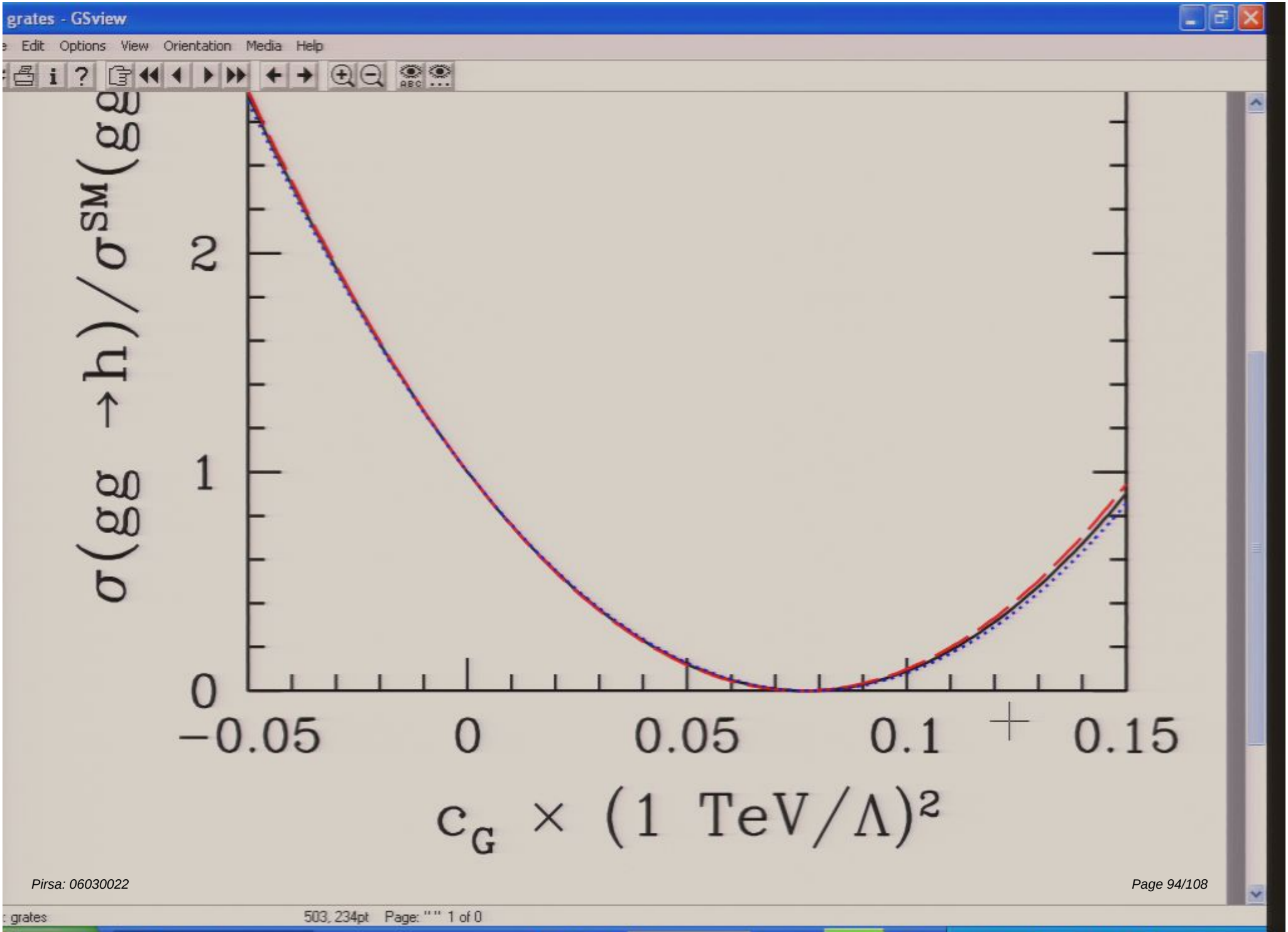

hGG
$\frac{\sigma(gg \to h)}{\sigma^{SM}(gg \to h)}$
$\Theta^{\mu}_{\mu} = m_t \bar{t}t + \frac{1}{2}\frac{\beta(g)}{g} G^A_{\mu\nu} G^{A\mu\nu}$
$\beta(g) = -\frac{g^3}{16\pi^2}\left(11 - \frac{2}{3}N_f\right)$

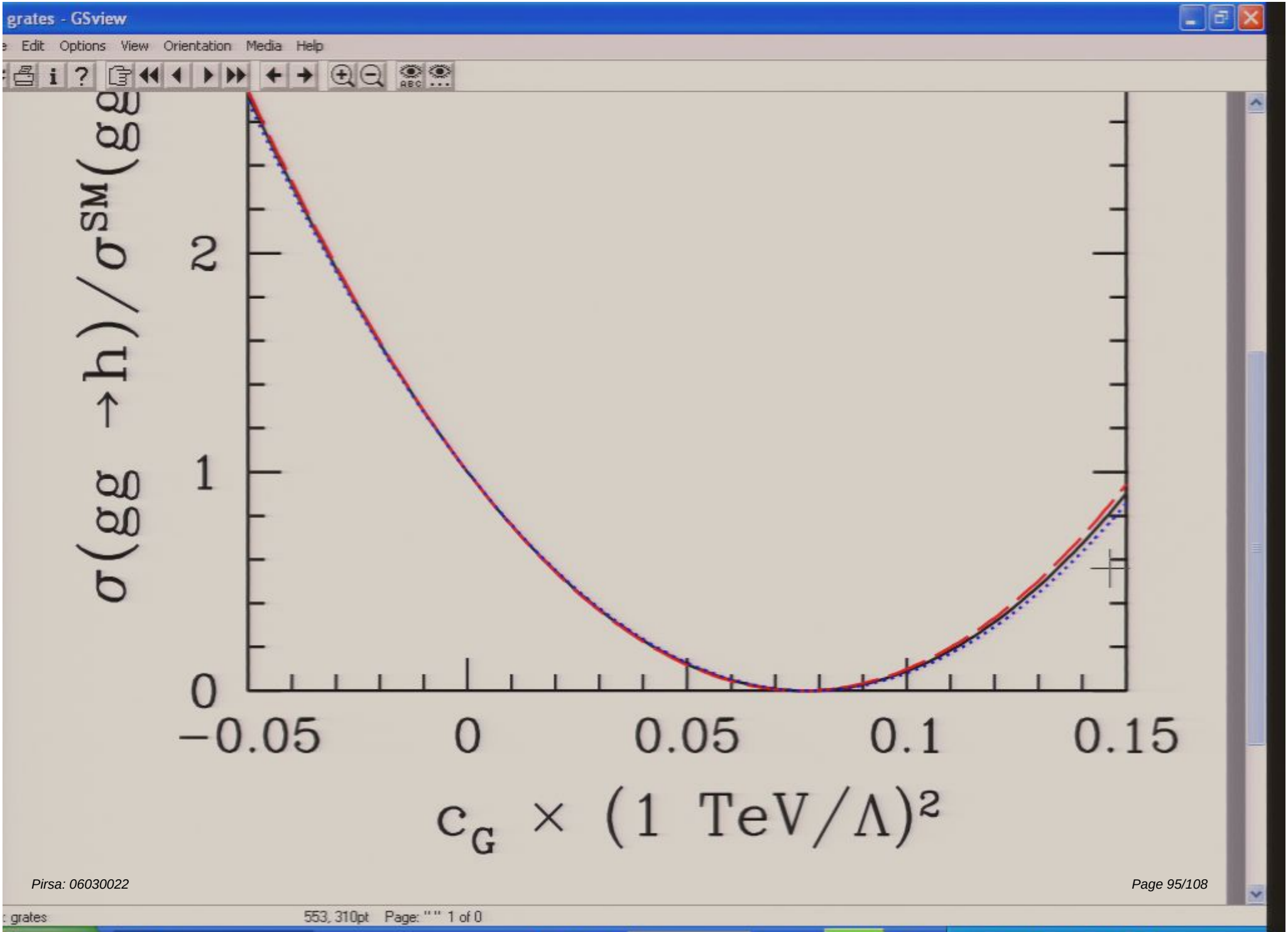

hGG
$\frac{\sigma(gg \to h)}{\sigma^{SM}(gg \to h)}$
$\Theta^{\mu}_{\mu} = m_t \bar{t}t + \frac{1}{2}\frac{\beta(g)}{g} G^{A}_{\mu\nu} G^{A\mu\nu}$
$\beta(g) = -\frac{g^3}{16\pi^2}\left(11 - \frac{2}{3}n_f\right)$

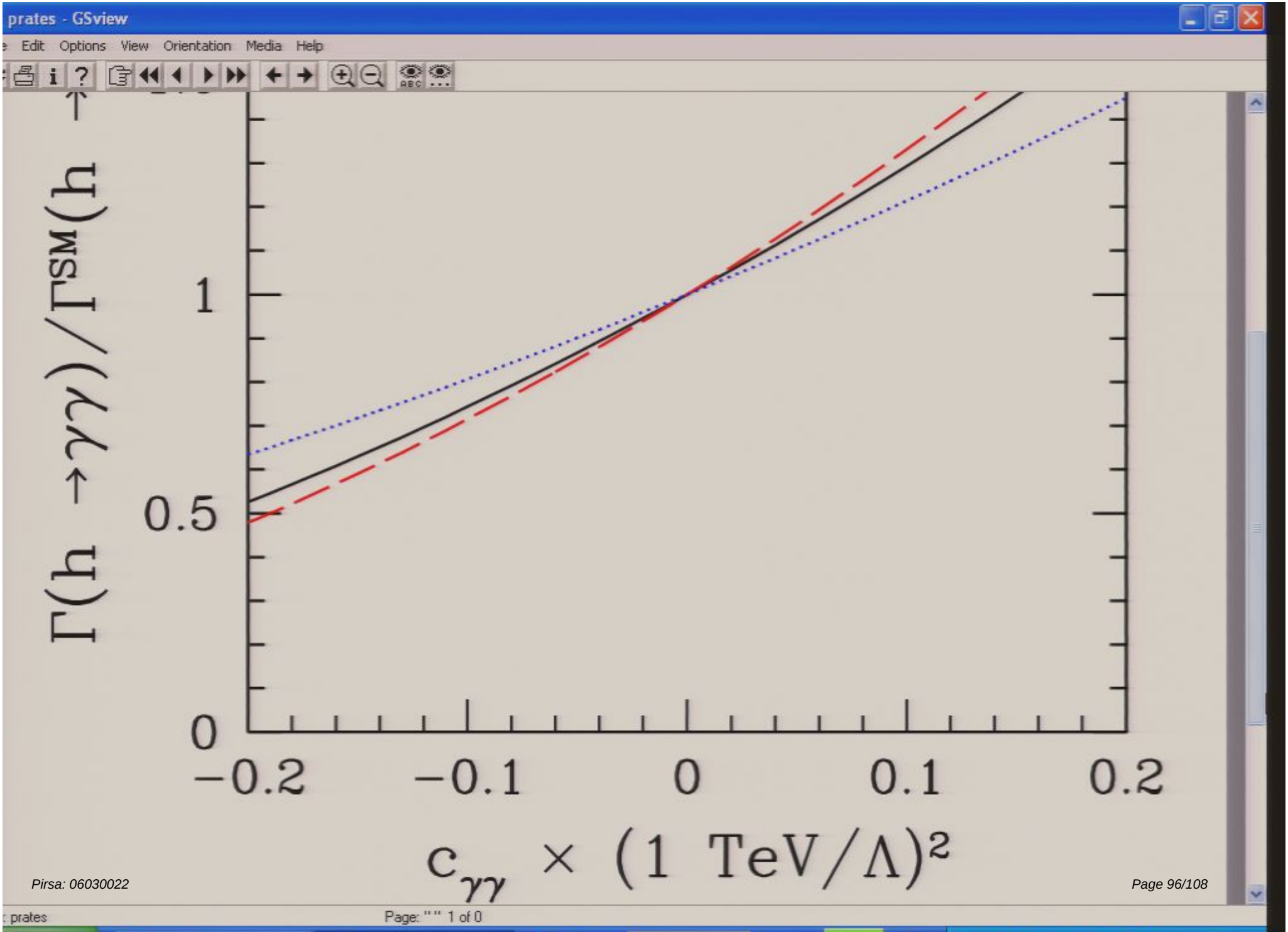

hGG
$M_t \bar{t}t \to -\left(\frac{2}{3}\frac{g_s^2}{16\pi^2}\right) G^a_{\mu\nu} G^{\mu\nu}$
$\frac{\sigma(gg \to h)}{\sigma^{SM}(gg \to h)}$
$\Theta^\mu_\mu = M_t \bar{t}t + \frac{1}{2}\frac{\beta(g)}{g} G^a_{\mu\nu} G^{\mu\nu}$
$\beta(g) = -\frac{g^3}{16\pi^2}\left(11 - \frac{2}{3}n_f\right)$


hGG
$m_t \bar{t}t \rightarrow -\left(\frac{2}{3}\frac{g_s^2}{16\pi^2}\right) G^a_{\mu\nu} G^{a\mu\nu}$
h
mtt
$\frac{\sigma(gg \to h)}{\sigma \propto M(gg \to h)}$
$\theta^\mu_\mu = m_t \bar{t}t + \frac{1}{2}\frac{\beta(g_s)}{g_s} G^a_{\mu\nu} G^{a\mu\nu}$
$\beta(g_s) < -\frac{g_s^3}{16\pi^2}\left(11 - \frac{2}{3}n_f\right)$


grates - GSview
Edit Options View Orientation Media Help
$\sigma(gg \to h)/\sigma^{SM}(gg$
2
1
0
−0.05
0
0.05
0.1
0.15
$c_G \times (1\ \mathrm{TeV}/\Lambda)^2$
Wireless networks detected
One or more wireless networks are in range of this computer.
To see the list and connect, click this message
grates
47, 329pt Page: "" 1 of 0


grates - GSview
Edit Options View Orientation Media Help
$\sigma(gg \to h)/\sigma^{SM}(gg$
2
1
0
−0.05
0
0.05
0.1
0.15
$c_G \times (1\ \mathrm{TeV}/\Lambda)^2$
grates
503, 234pt Page: " " 1 of 0


grates - GSview
Edit Options View Orientation Media Help
$\sigma(gg \to h)/\sigma^{SM}(gg$
2
1
0
−0.05
0
0.05
0.1
0.15
$c_G \times (1\ \mathrm{TeV}/\Lambda)^2$
grates
553, 310pt Page: " " 1 of 0


prates - GSview
Edit Options View Orientation Media Help
$\Gamma(h \to \gamma\gamma)/\Gamma_{SM}(h \to \gamma\gamma)$
1
0.5
0
−0.2
−0.1
0
0.1
0.2
$c_{\gamma\gamma} \times (1\ \mathrm{TeV}/\Lambda)^2$
prates
Page: "" 1 of 0

$2\Lambda^2$ $2\Lambda^2$

$$-\frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - \frac{C_{WB} g g_2}{2\Lambda^2} H^\dagger \tau^i H B_{\mu\nu} W^{i\mu\nu}$$

$$H = \begin{pmatrix} 0 \\ \frac{v+h}{\sqrt{2}} \end{pmatrix} \qquad \Lambda \sim 1\,\text{TeV}$$

$$H^\dagger H G^a_{\mu\nu} G^{a\mu\nu} \rightarrow \frac{v^2}{2} G^a_{\mu\nu} G^{a\mu\nu} + \frac{v^2 h}{v} G^a_{\mu\nu}$$

N.P.

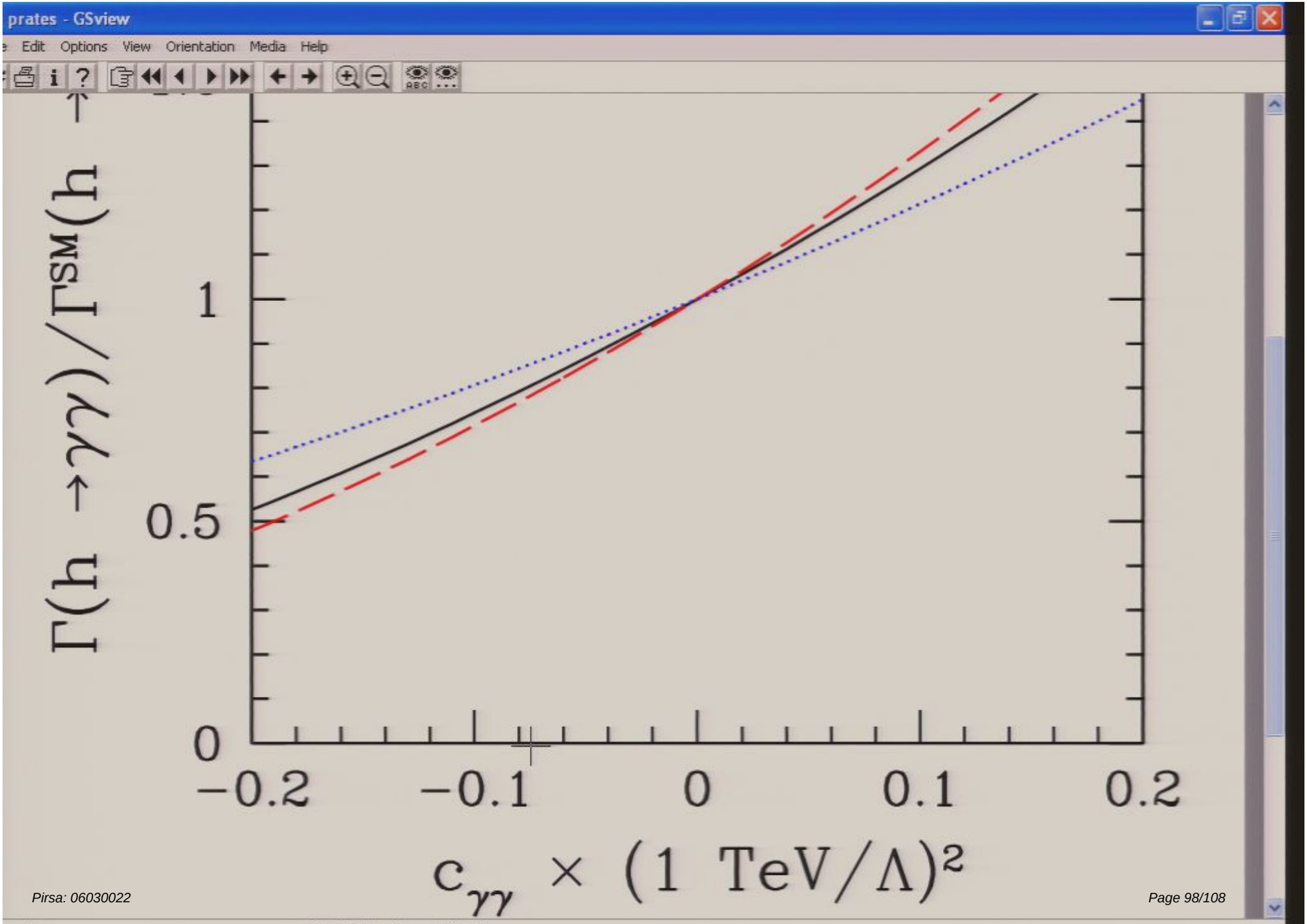
mass scale Λ

$$C_G \sim \frac{y_i^2 (N)}{16\pi^2}$$

$C_G \sim 0.01$

~ 0.1

0.2


prates - GSview
Edit Options View Orientation Media Help
$\Gamma(h \to \gamma\gamma)/\Gamma_{SM}(h \to \gamma\gamma)$
1
0.5
0
−0.2
−0.1
0
0.1
0.2
$c_{\gamma\gamma} \times (1\ \mathrm{TeV}/\Lambda)^2$
prates
260, 247pt Page: " " 1 of 0

$$\mathcal{L} = -\frac{C_G g_s^2}{2\Lambda^2} H^\dagger H G^a_{\mu\nu} G^{a\mu\nu} - \frac{C_W g_2^3}{2\Lambda^2} H^\dagger H W^a_{\mu\nu} W^{a\mu\nu}$$

$$- \frac{C_B g_1^2}{2\Lambda^2} H^\dagger H B_{\mu\nu} B^{\mu\nu} - \frac{C_{WB} g g_2}{2\Lambda^2} H^\dagger \tau^a H B_{\mu\nu} W^{a\mu\nu}$$

$$H = \begin{pmatrix} 0 \\ \frac{v}{\sqrt{2}} + \frac{h}{\sqrt{2}} \end{pmatrix}$$

$\Lambda \sim 1\,\text{TeV}$

$$H^\dagger H G^a_{\mu\nu} G^{a\mu\nu} \rightarrow \frac{v^2}{2} G^a_{\mu\nu} G^{a\mu\nu} + \frac{v h}{\sqrt{2}} G^a_{\mu\nu}$$

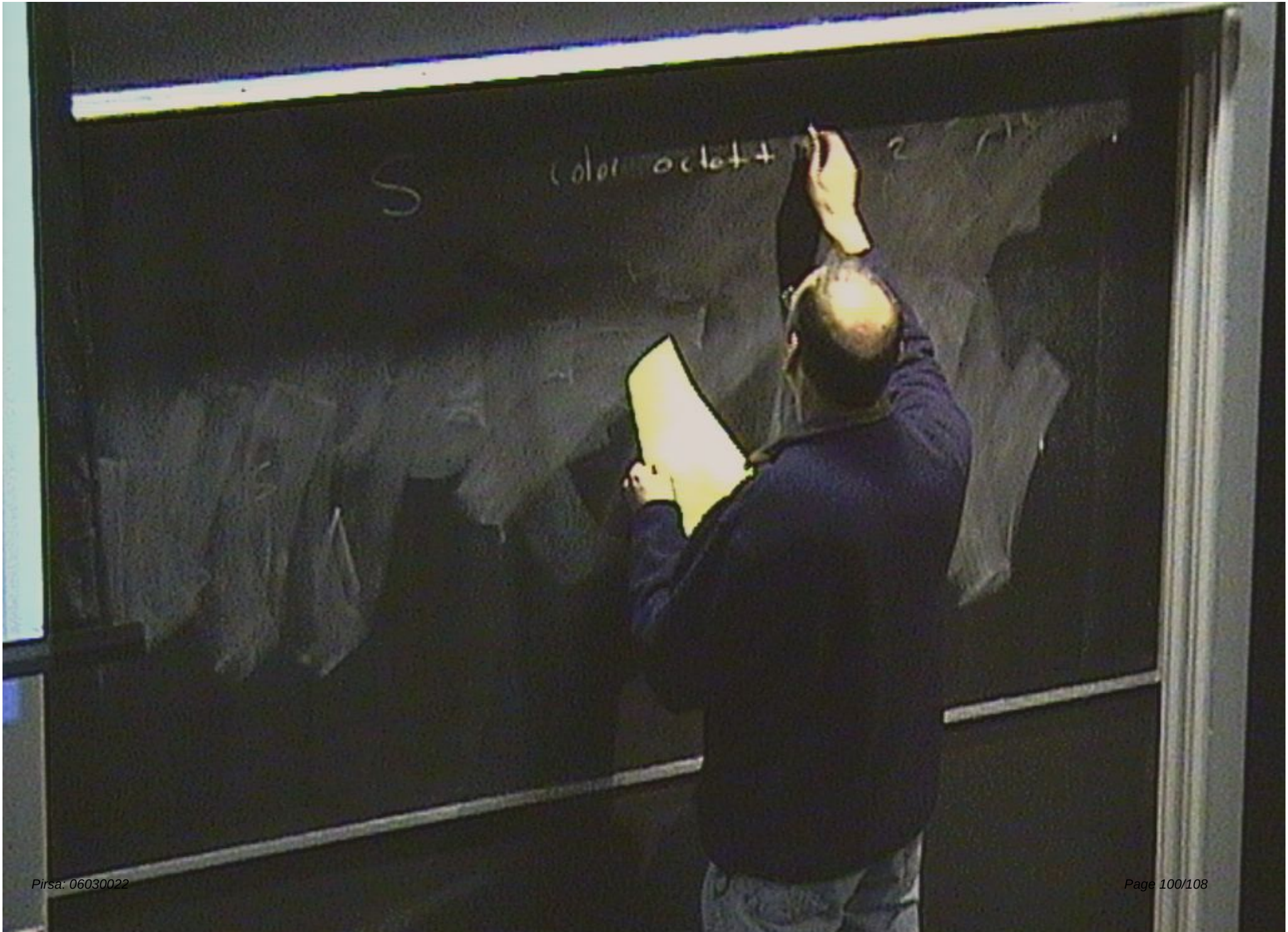
N.P

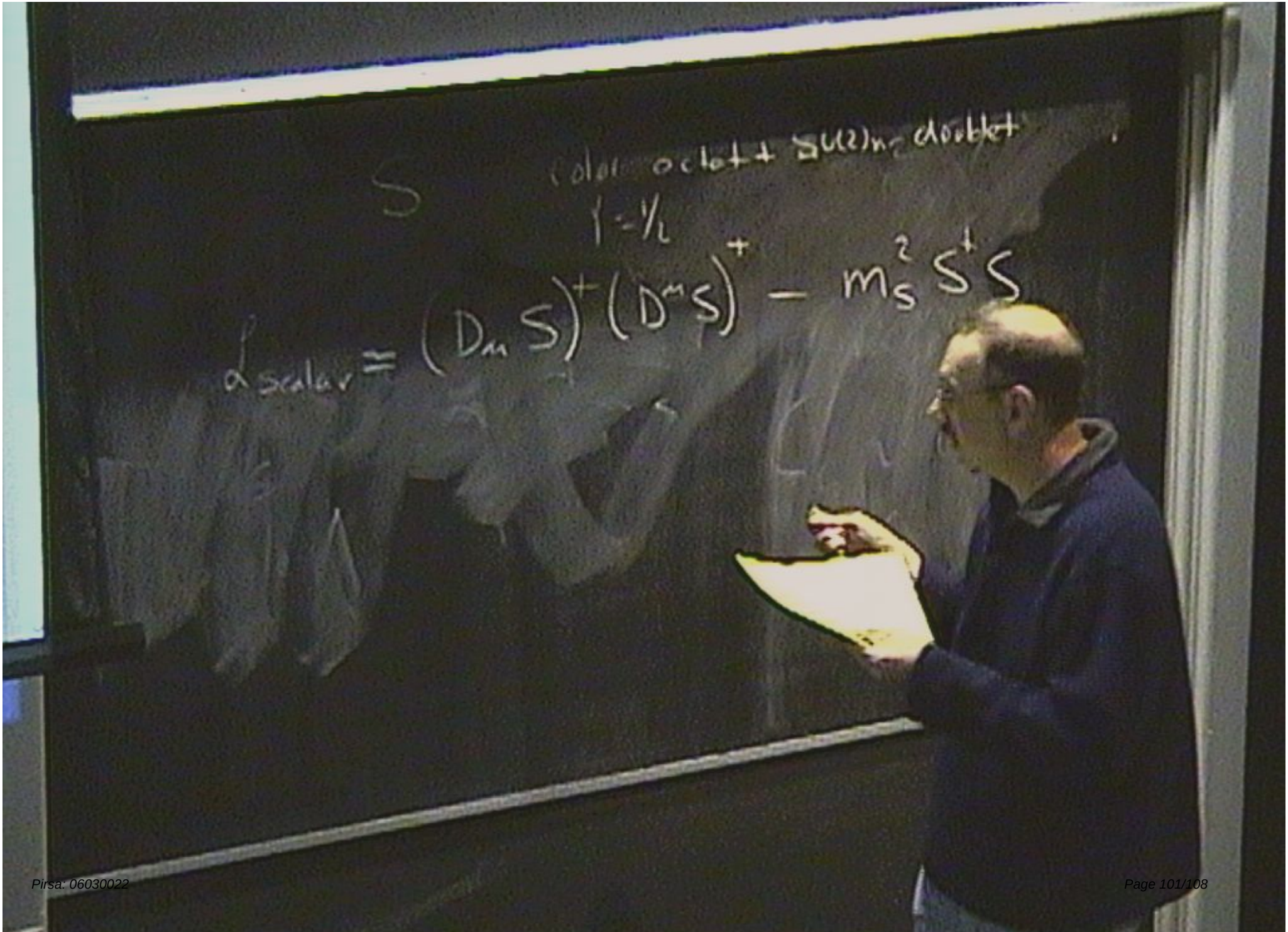
mass scale Λ

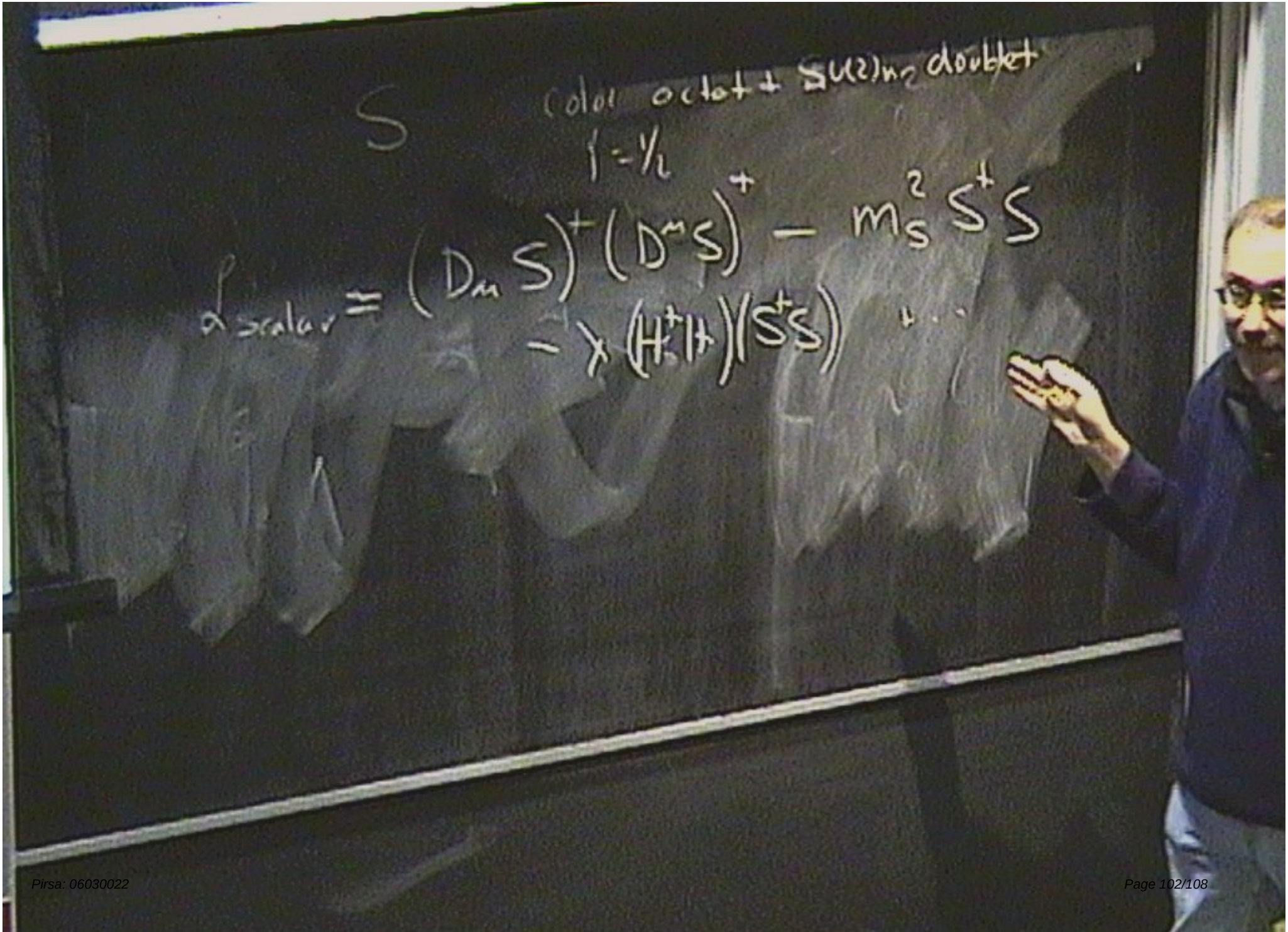
$$C_G \sim \frac{y_i^2 (N)}{16\pi^2}$$

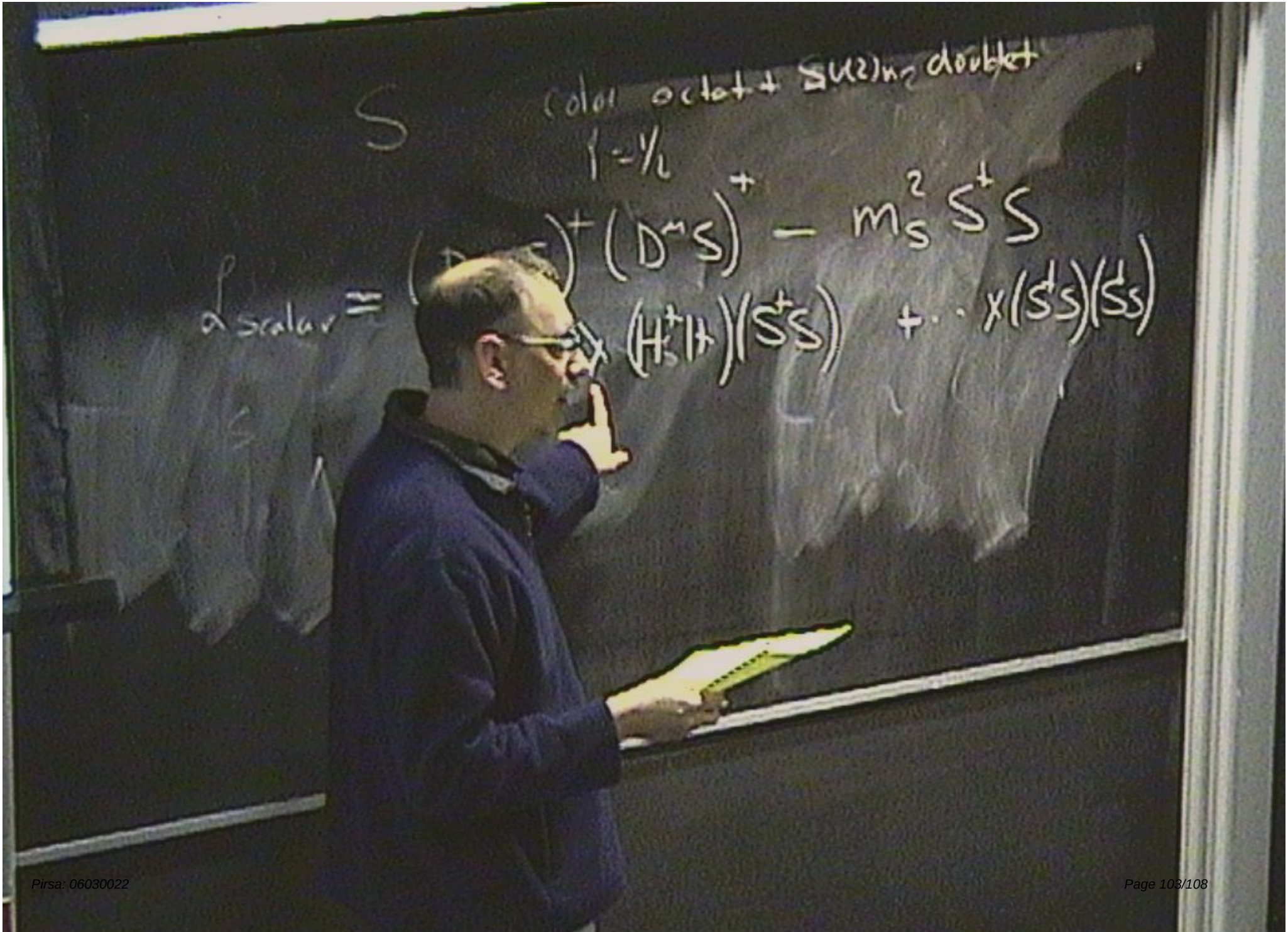
$C_G \sim 0.01$

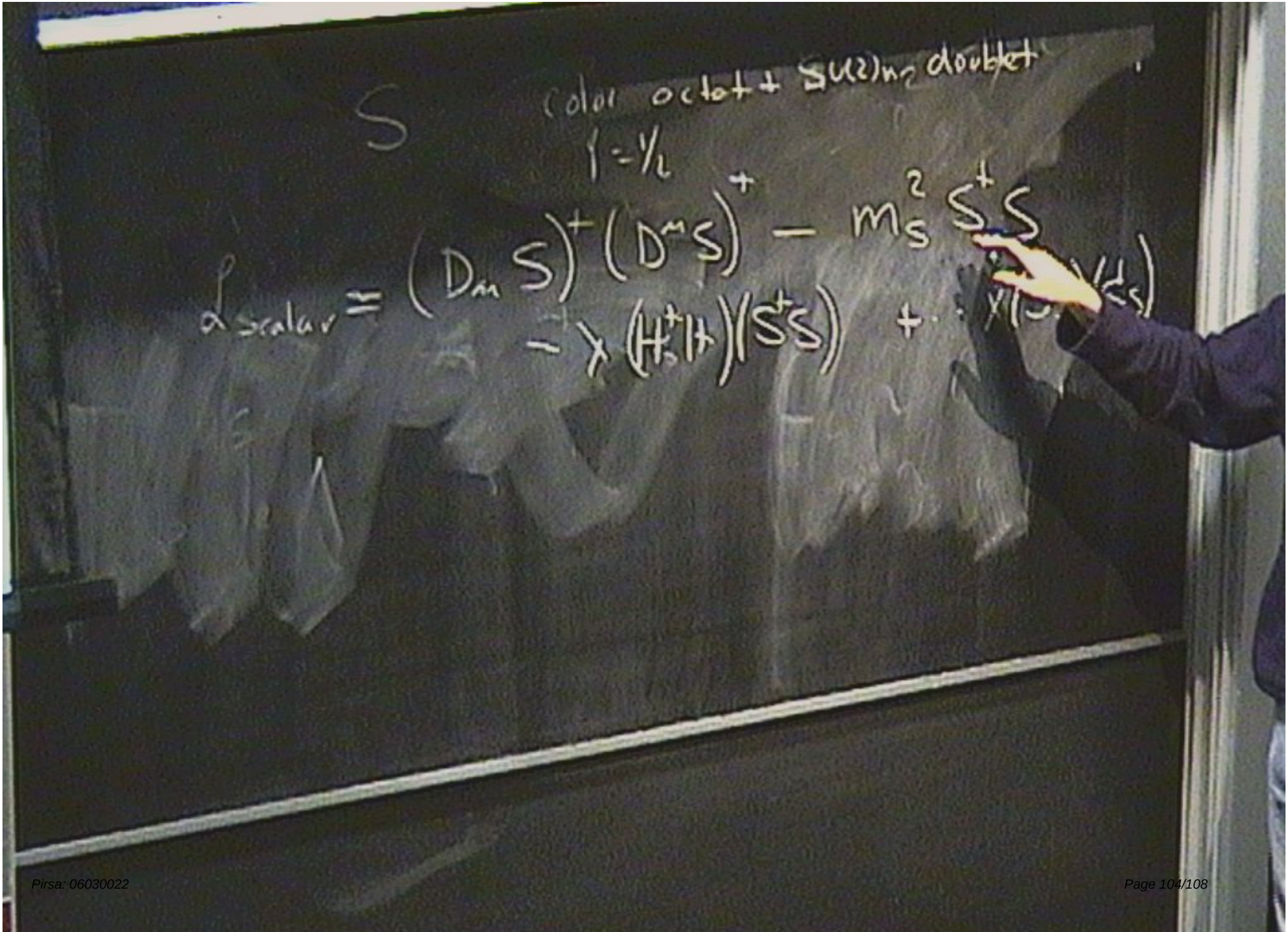
~ 0.1




S
color octet + SU(2)w doublet
Y = 1/2
$\mathcal{L}_{scalar} = (D_m S)^+ (D^m S) - m_S^2 S^+ S$


S
color octet + SU(2)_W doublet
I = 1/2
$\mathcal{L}_{scalar} = (D_\mu S)^\dagger (D^\mu S) - m_S^2 S^\dagger S$
$- \lambda (H^\dagger H)(S^\dagger S) + \ldots$


S
color octet + SU(2)w doublet
I = ½
$\mathcal{L}_{scalar} = (D^\mu S)^\dagger (D^\mu S) - m_S^2 S^\dagger S$
$+ \lambda_1 (H^\dagger H)(S^\dagger S) + \ldots \lambda (s^\dagger s)(S^\dagger S)$


S color octet + SU(2)w doublet
I = 1/2
$\mathcal{L}_{scalar} = (D_m S)^+ (D^m S) - m_S^2 S^+ S$
$- \lambda (H^+ H)(S^+ S)$ +

S color octet + SU(2)$_W$ doublet

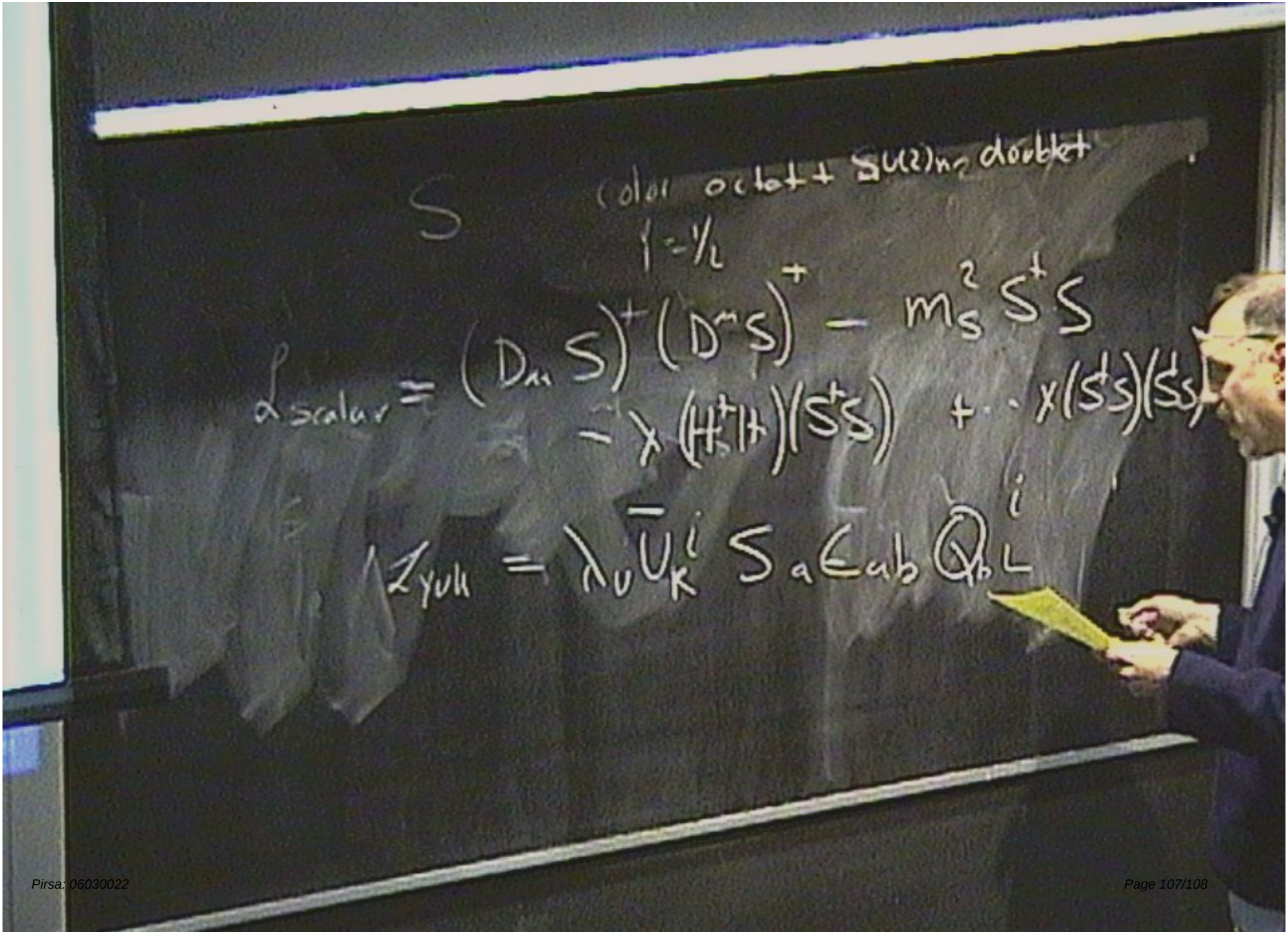
$I = 1/2$

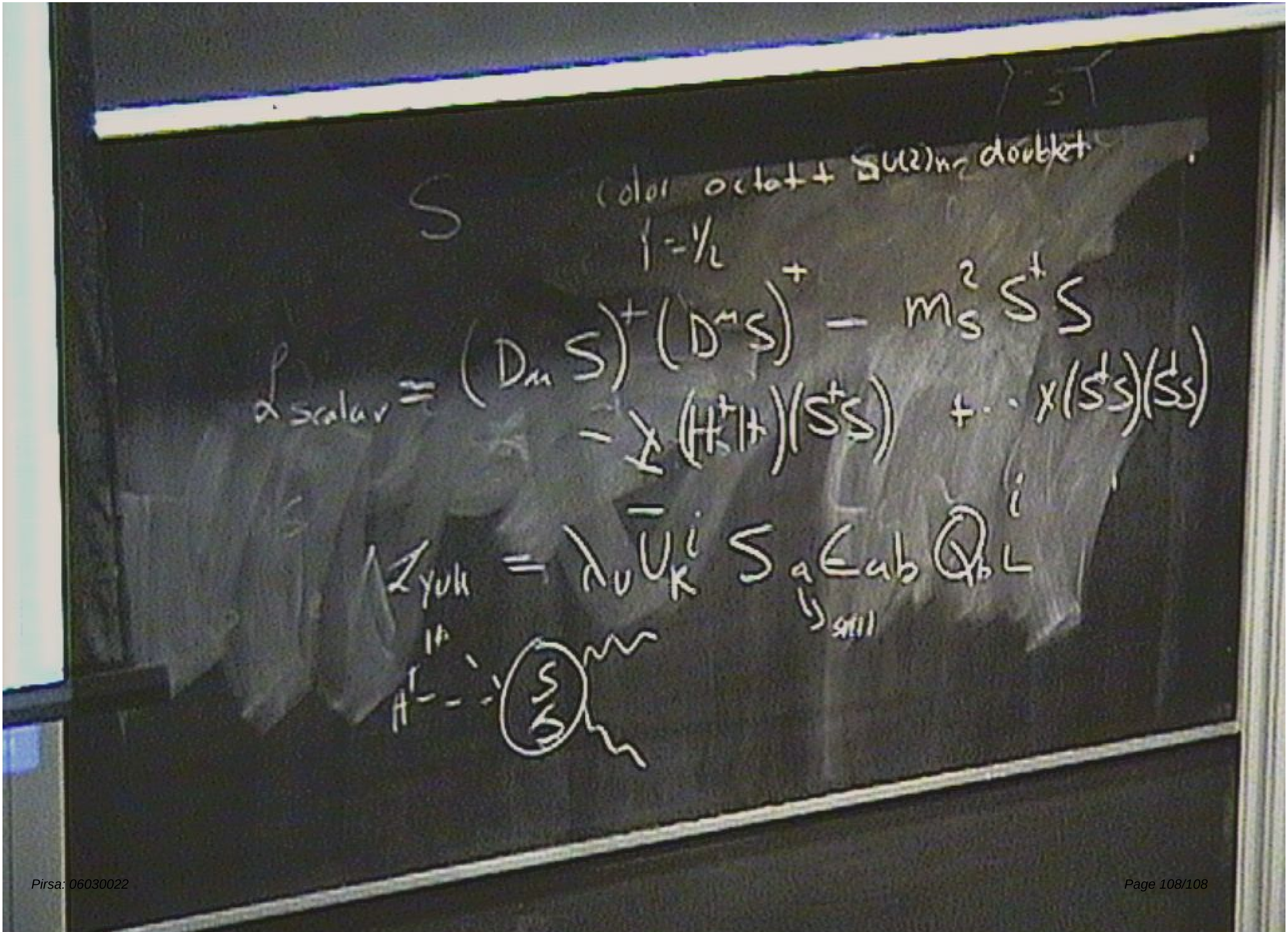
$$\mathcal{L}_{scalar} = (D_\mu S)^\dagger (D^\mu S) - m_S^2 S^\dagger S$$
$$- \lambda (H^\dagger H)(S^\dagger S) + \ldots \chi (S^\dagger S)(S^\dagger S)$$

S color octet + SU(2)$_{n_2}$ doublet

$Y = -1/2$

$$\mathcal{L}_{scalar} = (D_\mu S)^+ (D^\mu S) - m_S^2 S^+ S$$
$$- \lambda (H_5^+ H)(S^+ S) + \cdots \lambda (S^+ S)(S^+ S)$$


S
color octet + SU(2)_W doublet
I = 1/2
$\mathcal{L}_{scalar} = (D_\mu S)^+ (D^\mu S) - m_S^2 S^+ S$
$- \lambda (H^+ H)(S^+ S) + \cdots \lambda (S^+ S)(S^+ S)$
$\mathcal{L}_{Yuk} = \lambda_U \bar{U}_K^i S_a \epsilon_{ab} Q_{bL}^i$


S color octet + SU(2)_L doublet
Y = -1/2
L_scalar = (D_μ S)†(D^μ S) − m_S² S†S
− λ (H†H)(S†S) + · · x(S†S)(S†S)
L_yuk = λ_U Ū_R^i S_a ε_ab Q_bL^i
SU(2)
S
S